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Characterization of Hazardous Waste Sites - A Methods Manual. Volume 1 Site Investigations

Lockheed Engineering and Management Services Co.
Inc., Las Vegas, NV

Prepared for

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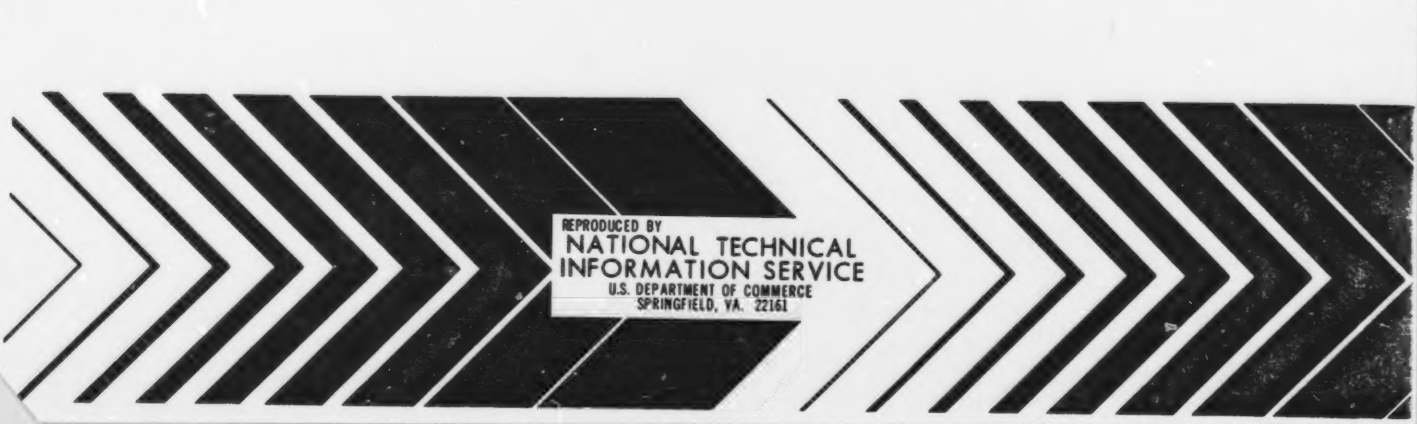
Characterization of Hazardous Waste Sites—A Methods Manual, Volume I—Site Investigations



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Site investigations is the first of three volumes of a methods manual prepared to give guidance on information gathering activities in support of the requirements specified in the National Oil and Hazardous Substances Pollution Contingency Plan. The National Contingency Plan contains a seven-phase approach to implementing the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Each phase represents a level of response dependent upon the situation. Information must be obtained to determine the appropriate level of environmental response.

Both remedial and enforcement actions under CERCLA require reliable site information. This volume describes approaches to obtaining this information and follows a semi-chronological order through subsequent phases of the National Contingency Plan. These steps range for preliminary data gathering, to site inspections, to large field investigations.

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VOLUME I
SITE INVESTIGATIONS

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NOTICE

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FOREWORD

Under guidance from an Agency-Wide Steering Group, this manual has been prepared by EPA's Office of Research and Development (ORD), primarily to provide methods to Agency program, regional, and enforcement offices, and secondarily, to provide guidance to states and contractors for characterization of hazardous waste sites.

At the first meeting of the Agency-Wide Steering Group for the Development of a Methods Manual for Characterization of Hazardous Waste Sites in August 1981, the scope of the planned Available Methods Manual was expanded from sampling and analysis to site characterization. The steering group agreed that sampling and analysis of hazardous wastes must be closely tied to sampling and analysis strategy. Before methods can be useful, they must be related to the purposes and objectives of sampling and analysis. Such an association leads to the necessity of considering all aspects of hazardous waste site characterization.

The objective of this manual is to provide field and laboratory managers, investigators, and technicians with a consolidated source of information on the subject of hazardous waste site characterization. The manual covers the range of endeavors necessary to characterize hazardous waste sites, from preliminary data gathering to sampling and analysis.

Because of the large number of subjects covered in this manual and the need to provide detailed methodology in the areas of sampling and sample analysis, this manual comprises three volumes:

Volume I - Site Investigations

Volume II - Available Sampling Methods

Volume III - Available Laboratory Analytical Methods

Volume I, the main text of the manual, discusses in somewhat general terms the many aspects of field investigation, the intent being to provide a working outline for the characterization process and to serve as a framework for the subsequent volumes. In this respect, Volumes II and III can be thought of as technical supplements to Volume I which build on the fundamental concepts and principles laid down in that document.

Volume I, Site Investigations, is a composite of several works. Much of the text was originally derived from the National Enforcement Investigation Center (NEIC) April 1980 draft manual, "Enforcement Considerations for Evaluation of Uncontrolled Waste Disposal Sites by Contractors" and supplemented with information contained in the Office of Emergency and Remedial Response (OERR)/ Ecology and Environment, Inc., June 1981, draft manual "Technical Methods for Investigating Sites Containing Hazardous Substances." Throughout subsequent drafts additional sources of material, either published or unpublished, were used and are cited in the body of the text, where applicable.

Volume II, Available Sampling Methods and Volume III, Available Analytical Methods are products of extensive literature and protocol review resulting in a collection of proven procedures for sampling and analyzing hazardous wastes. Both volumes are "Standard Methods" style manuals with Volume II organized by media and Volume III further subdivided by specific compounds or classes of compounds.

ABSTRACT

Site investigations is the first of three volumes of a methods manual prepared to give guidance on information gathering activities in support of the requirements specified in the National Oil and Hazardous Substances Pollution Contingency Plan. The National Contingency Plan contains a seven-phase approach to implementing the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Each phase represents a level of response dependent upon the situation. Information must be obtained to determine the appropriate level of environmental response.

Both remedial and enforcement actions under CERCLA require reliable site information. This volume describes approaches to obtaining this information and follows a semichronological order through subsequent phases of the National Contingency Plan. These steps range from preliminary data gathering, to site inspections, to large field investigations.

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SECTION 1

INTRODUCTION

STATUTORY AUTHORITY

The control of hazardous substances and the prevention of the entry of these substances into the environment is the objective of several acts passed by Congress. Rules regulating various aspects of hazardous waste can be attributed to the Toxic Substances Control Act (TSCA); the Clean Water Act (CWA); the Clean Air Act (CAA); the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA); the Safe Drinking Water Act (SDWA); the Resource Conservation and Recovery Act (RCRA); and in 1980, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). RCRA and CERCLA are the two that are most often associated with hazardous waste site investigations.

RCRA was passed to control industrial and municipal solid wastes, including sludges, slurries, etc., and to encourage the recovery of useful materials and energy from these wastes. The act also called for a tracking system to document the generation, transport, and disposal/storage of solid wastes. The discovery of a large number of uncontrolled and abandoned hazardous waste sites, such as at Love Canal, NY and Valley of the Drums, KY, prompted a much greater emphasis on the hazardous nature of the wastes. The regulations and resources of RCRA are now primarily devoted to the control of hazardous wastes, with a lesser emphasis on nonhazardous solid wastes. So great is the problem, that in 1980, legislation aimed at providing federal money for the cleanup of inactive waste disposal sites was enacted. The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), often called the "Superfund Act", provides regulatory agencies with the authority to deal with inactive sites, funds to deal with hazardous waste emergencies and a means to assign the liability of cleanup to the responsible parties. It also provides monies (Superfund) to pay for the mitigation of hazards from abandoned sites when no responsible party can be found or when the responsible party refuses to take action. In addition, it enpowers the government to seek compensation from responsible parties to recover funds used in mitigation actions.

Section 105 of the CERCLA requires that the National Contingency Plan (NCP), developed under the Clean Water Act, be revised to include procedures and standards for responding to releases of oil and hazardous substances. The revised plan reflects and effectuates the responsibilities and powers created by the Act.

Subpart F of the NCP, Hazardous Substance Response, establishes a seven-phase approach for determining the appropriate extent of a response authorized by CERCLA when any hazardous substance is released or there is a substantial threat of such a release into the environment, or there is a release or substantial threat of a release of any pollutant or contaminant which may present an imminent and substantial danger to the public health or welfare.

Each phase presented below sets specific criteria to establish the need for further action and progress into subsequent phases.

- Phase I - Discovery and Notification
- Phase II - Preliminary Assessment
- Phase III - Immediate Removal
- Phase IV - Evaluation and Determination of Appropriate Response - Planned Removal and Remedial Action
- Phase V - Planned Removal
- Phase VI - Remedial Action
- Phase VII - Documentation and Cost Recovery

This phased approach is the basis for implementation of all CERCLA - authorized Hazardous Substance Responses.

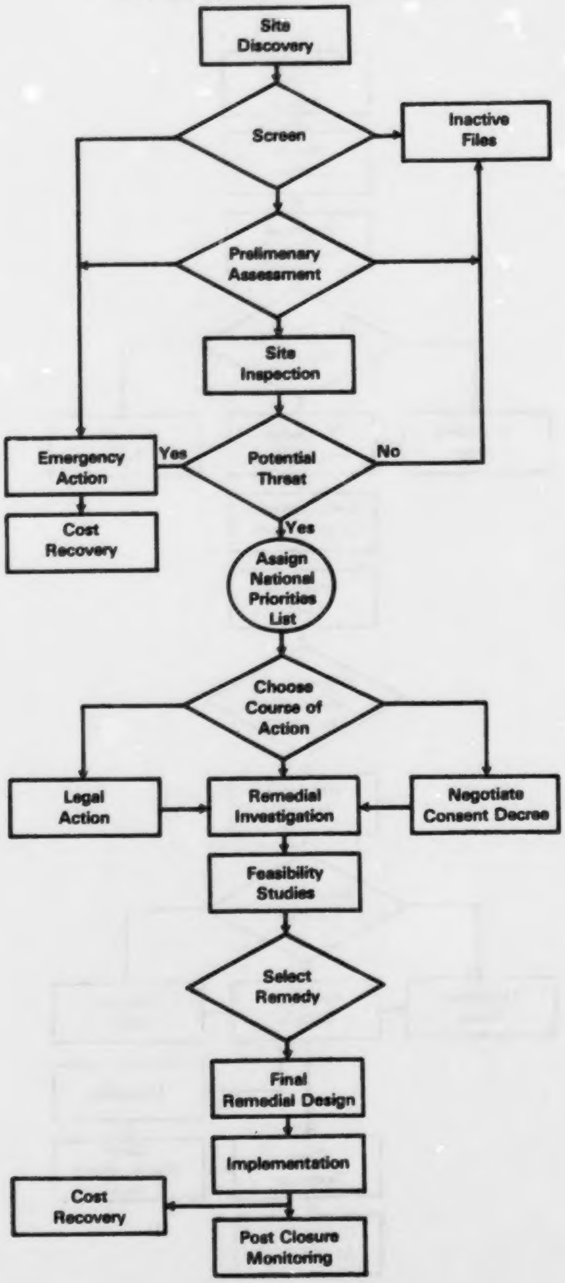
ADMINISTRATION

The NCP provides for a broad base of authorities to act within its guidance. In addition to the EPA and the U.S. Coast Guard, the Plan requests and encourages States to undertake authorized actions, and directs the EPA to provide funds to States (under cooperative agreements) for such actions.

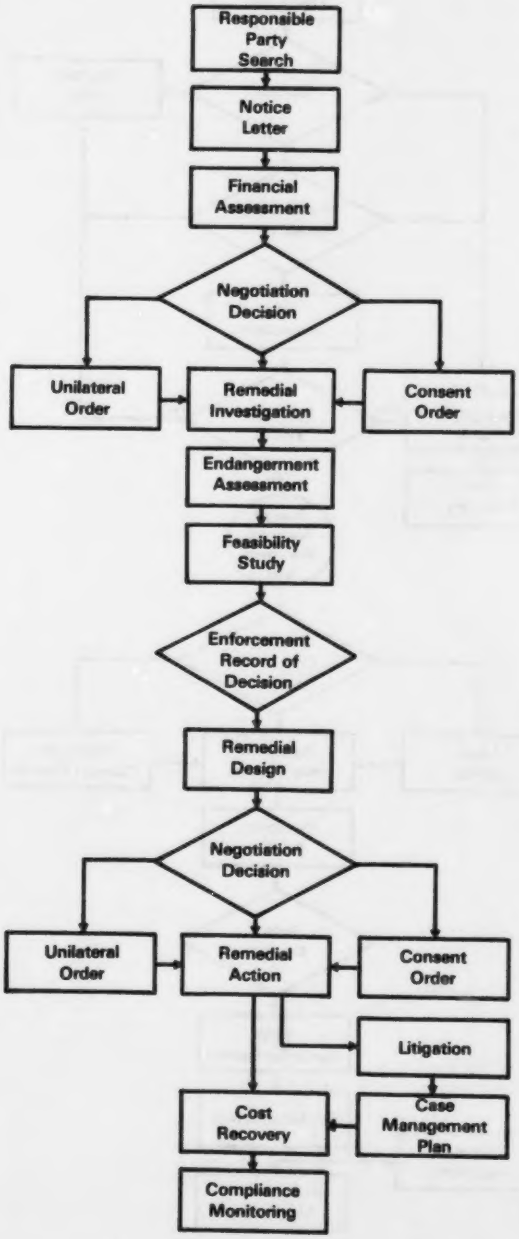
The Plan does not specify the mechanisms for implementation of the seven phases. The various EPA offices, primarily the Office of Emergency and Remedial Response (OERR) and the Office of Waste Programs Enforcement (OWPE), as well as the individual States each have developed programs specific to their needs in accordance with the NCP.

Figure 1-1 illustrates the series of tasks developed by OWPE and the essentially parallel tasks developed by OERR to implement the Plan. OWPE is charged with the enforcement of Phase VII - Documentation and Cost Recovery. As such, their investigation will differ from OERR, who is focused on remedial activities (Phases I-VI). Regardless of this difference in emphasis, the efforts of both offices are directed toward meeting the criteria of the various phases of the NCP. A common component of both programs is the need to gather data. The U.S. Environmental Protection Agency has prepared a three-volume manual to provide field and laboratory managers, investigators and technicians with a consolidated source of information and guidance on data gathering procedures including preliminary site assessment, sample collection, and sample analysis.

Superfund Site Management Plan



Enforcement Site Management Plan



This three-volume manual identifies available procedures, provides detailed guidance for implementing these procedures, and provides a framework for assessing research needs in the area of hazardous waste characterization methodology. The contents of each volume is summarized below.

Volume I. Site Investigations provides a management strategy for undertaking an investigation of a hazardous waste site.

Volume II. Available Sampling Methods provides a discussion of available sampling techniques and guidance on the appropriate use of each technique.

Volume III. Available Laboratory Analytical Methods provides guidance on preparation and analysis of hazardous waste samples and other environmental samples that may be collected during a site investigation.

Volume I, Site Investigations describes policies and procedures common to all data gathering efforts, such as personal conduct, document control, and quality assurance. Additionally, guidance is provided on the extent to which safety precautions which must be considered. Subsequent sections provide a framework for gathering the required information. They detail what information is necessary, where that information can be found and how the information can be acquired.

SECTION 2

ADMINISTRATIVE PROCEDURES

INTRODUCTION

The understanding of certain administrative procedures and legal considerations prior to the onset of onsite actions is paramount for successful program management. The purpose of this section, therefore, is to present topics such as investigative conduct, documentation and recordkeeping, quality assurance, site entry, etc., from the viewpoint of Agency policy. Although this discussion is based on EPA policy, it can serve as a guideline for anyone conducting a hazardous waste site investigation. Where necessary, the technical aspects of these topics will be addressed in subsequent sections of this document.

INVESTIGATIVE CONDUCT

Professionalism

Personnel are expected to perform their duties in a professional and responsible manner. Persons conducting hazardous waste site investigations must:

- develop and report the facts of an investigation completely, accurately, and objectively;
- conduct themselves at all times in accordance with the regulations in the EPA handbook Employee Responsibilities and Conduct (Title 40 CFR, Part 3) or in other pertinent guidelines for personnel conduct;
- avoid, in the course of an investigation, any act or failure to act which could be considered to have been motivated by reason of personal or private gain; and
- make a continuing effort to improve their professional knowledge and technical skills.

Prohibited Actions

Attempted Bribery--

Money may be offered by persons whose activities are being investigated. Offers are usually made by people unfamiliar with EPA rules and regulations. Other offers may be blatant attempts to whitewash a serious violation or condition, or to cause the withholding of damaging information or observations. Investigative personnel must:

- ask "What is this for?" if offered something of value;
- explain politely, if the offer is repeated, that both parties to such a transaction may be guilty of violating the Federal statutes;
- not accept money or goods of any kind; and
- immediately report the incident in detail to their supervisor.

Conflicts of Interest--
A conflict of interest may exist whenever an EPA employee has a personal or private interest in a matter which is relevant to his official duties and responsibilities. It is important to avoid even the appearance of a conflict of interest because the appearance of a conflict damages the integrity of the Agency and its employees in the eyes of the public. All employees must, therefore, be constantly aware of situations which are, or give the appearance of, conflicts of interest when dealing with others in or outside of the government. For a detailed discussion of the situations and/or activities which may result in conflict of interest, personnel are directed to the reprint publication Employee Resonsibilities and Conduct (Title 40 CFR, Part 3).

Gifts, Gratuities, Favors, Luncheons, Etc.--
An EPA employee is forbidden to solicit or accept any gift, gratuity, entertainment (including meals), favors, loans, or any other thing of monetary value from any person, corporation, or group which has a contractual or financial relationship with EPA, which has interests that may be substantially affected by such employee's official actions, or which conducts operations regulated by EPA. Acceptance of food and refreshments of nominal value, such as luncheon during a plant tour where the arrangements are consistent with the transaction of official business, is an exception.

Dress

Good public relations and common sense require that personnel dress appropriately for the circumstances. When conducting an offsite reconnaissance where hazards should be minimal, contact with the public will occur; therefore, regional policy relative to proper attire should be followed. Onsite inspections will require that personnel be protected from unknown hazards or toxic materials. Required protective clothing and breathing apparatus are described in Section 3.

Public Relations

It is important that cooperation be obtained and good working relationships be established when working with the public. This can best be accomplished by using diplomacy and tact. Even a hostile person should be treated with courtesy and respect. Personnel should not speak derogatorily of any person, regulatory agency, manufacturer, or industrial product. All information acquired in the course of duty is for Official Use Only.

DOCUMENTATION

General

Hazardous waste site investigations generally involve several government program offices, a number of private contractors, scores of individuals, and often generate enormous volumes of information. This information must be collected and maintained within a system that allows for precise and expedient access. Further, it must protect all records as potential evidence that may be required for enforcement actions. It is therefore imperative that a comprehensive document control system be implemented during all phases of an evaluation.

For a number of years, EPA's National Enforcement Investigations Center (NEIC) has provided guidance for the careful recording and tracking of all information, data, and samples collected in support of an environmental investigation, especially with respect to enforcement. This guidance can be found in the NEIC Policies and Procedures Manual, EPA-330-78-001R, May 1978 (revised December 1981), which serves as the basis for this subsection as well as Appendix D of Volume II.

The advent and current widespread use of personal computers further enhances the usefulness and ease with which data can be managed in support of enforcement actions and site characterization. Using either custom developed software or currently available data base management software, computer assisted document control systems have proven successful for handling, tracking and manipulating large quantities of information with relative ease. Compared to manual record keeping practices, these automated systems can be of great utility. Although not meant to be a replacement for physical evidence (field logs, tags, labels, etc.) these systems can alleviate tedious record searching, sorting, and storage tasks and can provide quick and easy retrieval of information with cross references to stored evidentiary material.

Document Control

The purpose of document control is to assure that all project documents issued to or generated during hazardous waste site investigations will be accounted for when the project is completed. The purpose is achieved through a program which makes all investigation documents accountable. This should include serialized document numbering, document inventory procedures, and an evidentiary filing system.

Accountable documents used or generated during investigations include:

- Project Work Plans,
- Project Logbooks,
- Field Logbooks,
- Sample Data Sheets,

- Sample Tags,
- Chain-of-Custody Records and Seals,
- Laboratory Logbooks,
- Laboratory Data, Calculation, Graphs, etc.,
- Sample Checkout,
- Sample Inventory,
- Internal Memos,
- External Written Communication,
- Business Confidential Information,
- Photographs, Drawings, Maps,
- Quality Assurance Plan,
- Litigation or Enforcement Sensitive Documents, and
- Final Report.

Each document bears a serialized number and is listed, with the number, in a project document inventory assembled at the project's completion. Volume II, Appendix D, provides further discussion of Document Control/Chain-of-Custody Procedures.

Serialized Documents--

All serialized documents are assigned to the Document Control Officer. The Document Control Officer is responsible for ensuring that a sufficient supply of documents is obtained for an investigation and that these documents are properly distributed to the appropriate personnel. The Document Control Officer will maintain a list of the serialized project documents that were issued to personnel for that project.

Project Logbooks--

The logbook of the team leader will document the transfer of logbooks to the individuals who have been designated to perform specific tasks on the survey. All pertinent information must be recorded in these logbooks from the time each individual is assigned to the project until the project is completed. All logbooks are the property of EPA and are to be returned to the Document Control Officer upon completion of the inspection/investigation.

All logbook entries must be dated, legible, and initialed and contain accurate and inclusive documentation of an individual's project activities. Because the logbook forms the basis for the later written reports, it must contain only facts and observations. Language should be objective, factual, and free of personal feelings or other terminology which might prove inappropriate. Entries made by individuals other than the person to whom the logbook was assigned are dated and signed by the individual making the entry. Individuals must sign each logbook assigned to them.

Field Data Records--

Serialized Field Data Records (FDRs) in the form of individual sheets or bound logbooks are maintained for each inspection or investigation and the project code is recorded on each page. The Project Coordinator also numbers the FDR covers with the appropriate project code. All in-situ measurements and field observations are recorded in the FDRs with all pertinent information necessary to explain and reconstruct sampling operations. Each page of a Field Data Record is dated and signed by all individuals making entries on that page. The Coordinator and the field team on duty are responsible for ensuring that FDRs are present during all monitoring activities and are stored safely to avoid possible tampering. Any lost, damaged, or voided FDRs are reported to the team leader.

Sample Identification--

All necessary serialized sample tags are distributed to field personnel by the team leader or designated team member. Individuals are accountable for each tag assigned to them. A tag is considered to be in their possession until it has been filled out, attached to a sample, and transferred to another individual with the corresponding Chain-of-Custody Record. At no time are any sample tags to be discarded and if any tags are lost, voided, or damaged, this is noted in the appropriate FDR or logbook immediately upon discovery and the team leader is notified. At the completion of the field investigation activities, team leaders are accountable for all serially-numbered documents including tags. Tags attached to those samples split with the source or another government agency are accounted for on a Sample Receipt Record. Figure 2-1 illustrates an example of an acceptable sample tag.

Chain-of-Custody Records--

Each person involved with the sample must know Chain-of-Custody procedures. The procedures should be included in the Project Plan or be published and available to all personnel. Due to the evidentiary nature of sample collecting investigations, the possession of samples must be traceable from the time that samples are collected until they are introduced as evidence in legal proceedings. To maintain and document sample possession, Chain-of-Custody procedures are followed.

Serialized Chain-of-Custody Records (e.g., Figure 2-2) are assigned and accounted for in a manner similar to that used for sample tags. If samples are transferred to the laboratory, the white original is filed in the laboratory's designated security container. The carbonless copy of the Custody Record is returned to the team leader. A similar procedure is followed when dispatching samples via common carrier, mail, etc., except that the original accompanies the shipment and is signed and retained by the receiving laboratory sample custodian. The carbonless copy is retained by the team leader.

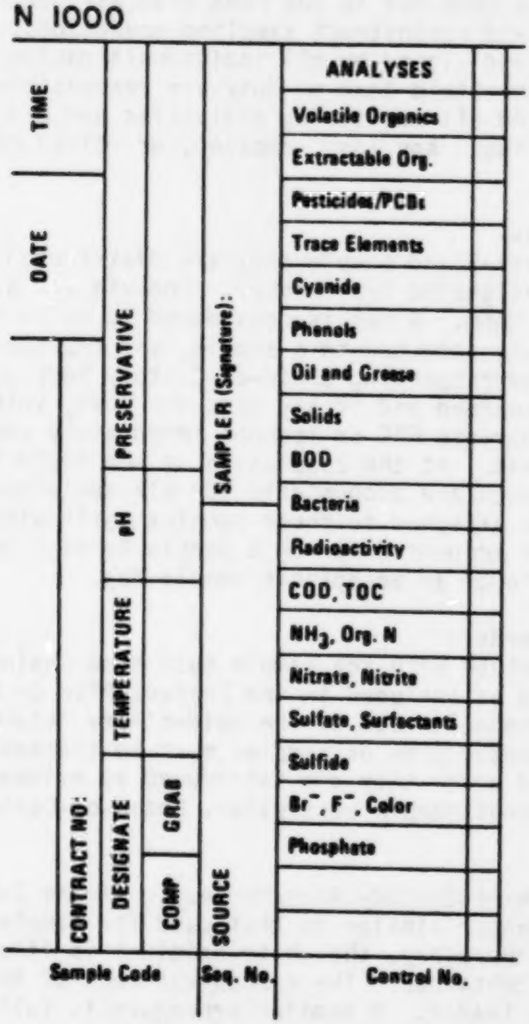
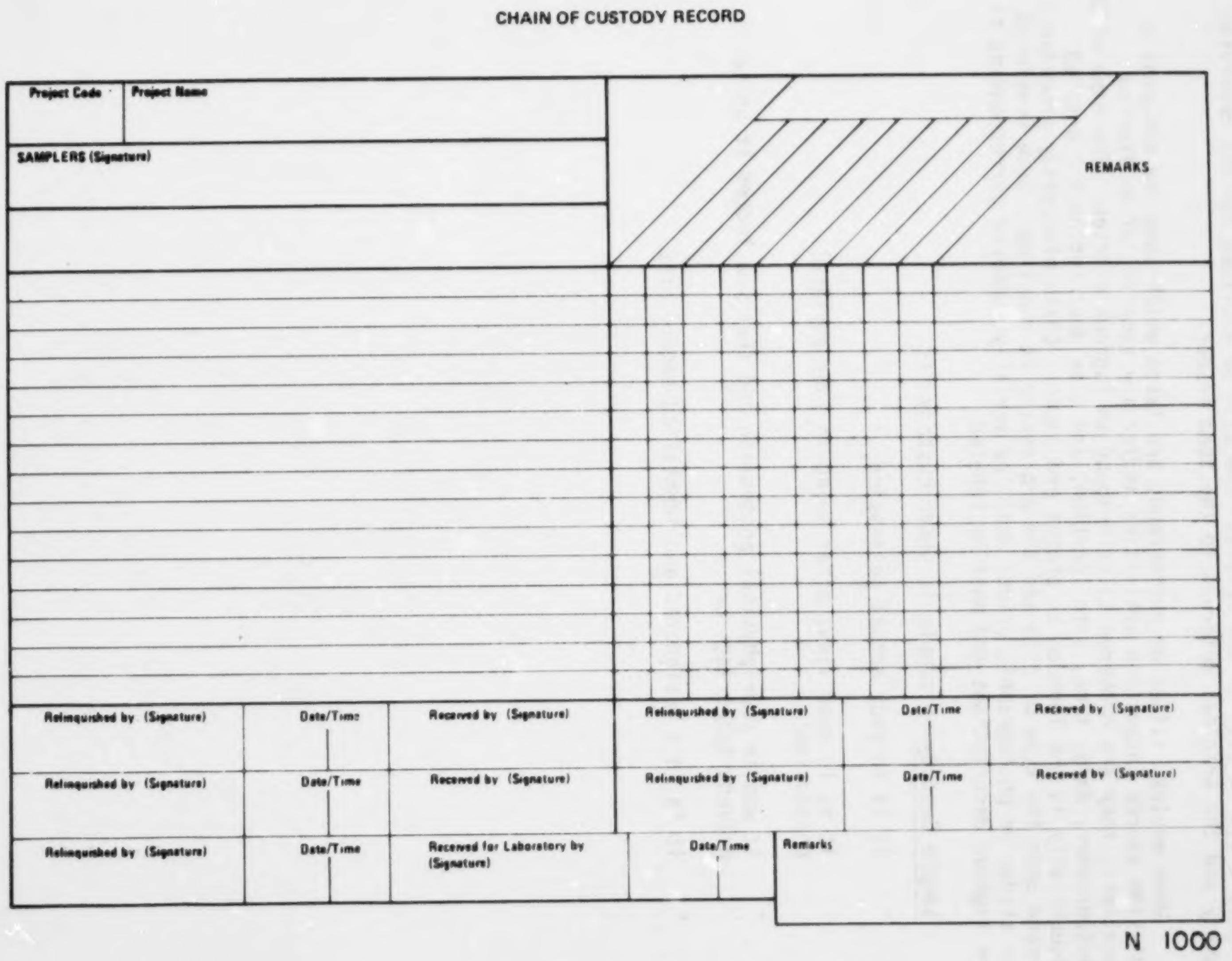


Figure 2-1. Sample Collection tag.



CHAIN OF CUSTODY RECORD

Project Code	Project Name	REMARKS
SAMPLERS (Signature)		

Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
Relinquished by (Signature)	Date/Time	Received for Laboratory by (Signature)	Date/Time	Remarks	

N 1000

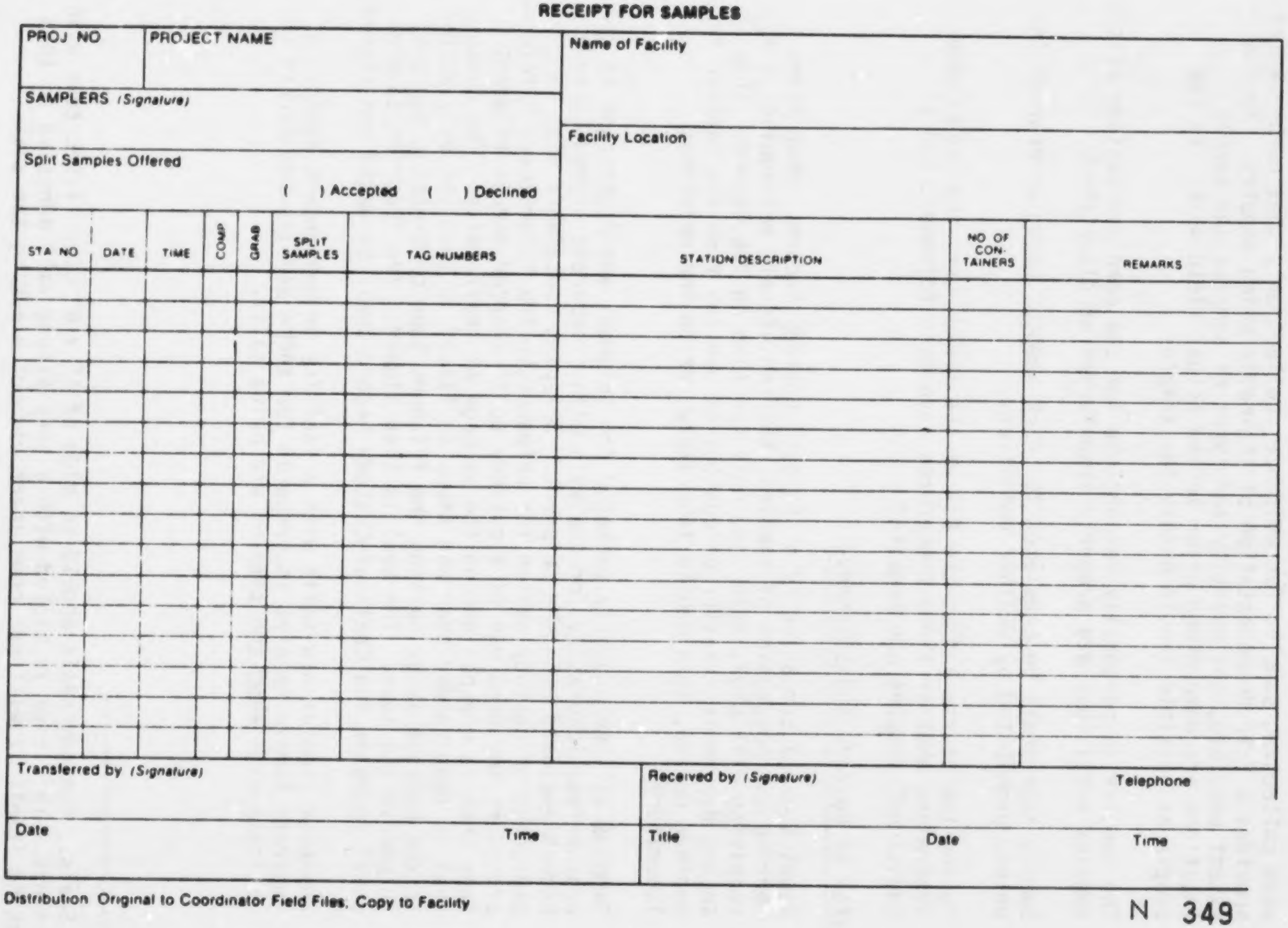
Figure 2-2. Chain-of-custody form.

When samples are split with the source or another government agency, the tag serial numbers from all splits are recorded on the Sample Receipt Form (Figure 2-3). A copy of the receipt form will be provided for the receiving agency and the original returned to the team leader.

When movies, slides or photographs are taken which show the effluent or emission source inspection activities and/or any sampling of monitoring locations, they are numbered to correspond to logbook entries. The name of the photographer, date, time, site location, and site description are entered sequentially in the logbook as photos are taken. Chain-of-custody procedures depend upon the type of film and the processing it requires. Once developed, the slides or photographic prints shall be serially-numbered corresponding to the logbook descriptions and must be labeled.

Sample Custody--A sample is under custody if:

- it is in your actual possession;
- it is in your view, after being in your physical possession;
- it was in your physical possession and then you locked it up to prevent tampering; or
- it is in a designated and identified secure area.



RECEIPT FOR SAMPLES

PROJ NO

PROJECT NAME

Name of Facility

SAMPLERS *(Signature)*

Facility Location

Split Samples Offered

( ) Accepted ( ) Declined

STA NO	DATE	TIME	COMP	GRAB	SPLIT SAMPLES	TAG NUMBERS	STATION DESCRIPTION	NO OF CON-TAINERS	REMARKS

Transferred by *(Signature)*

Received by *(Signature)*

Telephone

Date

Time

Title

Date

Time

Distribution Original to Coordinator Field Files, Copy to Facility

N 349

Figure 2-3. Receipt for sample form.

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Field Custody Procedures--

- When collecting samples for evidence, collect only that number which provides a fair representation of the media being sampled. To the extent possible, the quantity and types of samples and sample locations are determined prior to the actual field work. As few people as possible should handle the samples.

- The sampler is personally responsible for the care and custody of the samples until they are properly transferred or dispatched.

- Sample tags shall be completed for each sample, using waterproof ink unless prohibited by weather conditions.

- During the course and at the end of the field work, the Team Leader determines whether these procedures have been followed, and if additional samples are required.

Transfer of Custody and Shipment--

- Samples are accompanied by a Chain-of-Custody Record. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the Record. This Record documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, or to the permanent laboratory.

- Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed Custody Record enclosed with the shipment. Shipping containers will be padlocked or custody-sealed for shipment to the laboratory. Preferred procedure includes use of a custody seal* wrapped across filament tape that is wrapped around the package at least twice. The custody seal is then folded over and stuck to itself so that the only access to the package is by cutting the filament tape or breaking the seal to unwrap the tape. The seal is then signed. The "Courier to Airport" space on the Chain-of-Custody Record shall be dated and signed.

- Whenever samples are split with a facility or government agency, a separate Sample Receipt is prepared for those samples and marked to indicate with whom the samples are being split.

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*Custody Seals. Custody seals should be made of 1" x 6" U.L. litho tape with security slots. This tape is backed with a very strong self adhesive so that once stuck to itself it will not come apart without breaking the seal.

- All packages will be accompanied by the Chain-of-Custody Record showing identification of the contents. The original Record will accompany the shipment, and a copy will be retained by the Project Leader.

- If sent by common carrier, a Bill of Lading must be used. Receipts of Bills of Lading and shipping documents as well as all receipts will be retained as part of the permanent documentation.

Corrections to Documentation--

As previously noted, all original data recorded in logbooks, Field Data Records, Sample Tags, Custody Records, Sample Receipt Forms, and other data sheet entries are written with waterproof ink. None of the accountable serialized documents listed above are to be destroyed or thrown away even if they are illegible or contain inaccuracies which require a replacement document.

If an error is made on an accountable document assigned to one individual, that individual may make contemporaneous corrections simply by crossing a line through the error and entering the correct information. Any subsequent error discovered on an accountable document should be corrected by the person who made the entry. All subsequent corrections must be initialed and dated.

If a Sample Tag is lost in shipment, or a tag was never prepared for a sample, or a properly tagged sample was not transferred with a formal Chain-of-Custody Record, a written statement is prepared detailing how the sample was collected, and whether it was air-dispatched or hand-transferred to the laboratory. The statement should include all pertinent information, such as entries in field logbooks regarding the sample, whether the sample was in the sample collector's physical possession or in a locked compartment until hand-transferred to the laboratory, etc. Copies of the statement are distributed to the team leader or Document Control Officer and to the project file.

Document Numbering System and Inventory Procedure--

To provide document accountability to the appropriate individuals, each of the document categories discussed above features a unique serialized number for each item within the category. Logbooks, Field Data Records, Sample Tags, Chain-of-Custody Records, and Sample Receipt Forms are serially numbered by the Document Control Officer before assignment to the team leader. The logbooks and Field Data Records are usually given a five-digit number, with the project code as the first three digits followed by a two-digit document number. Sample tags and custody records are labeled with a four-digit document number and the project code. All documentation not covered by the above (logbooks, data sheets, graphs, etc.) are uniquely and serially-numbered using the project code as part of the number. Documents are then listed on an inventory sheet.

Confidential Information--

EPA recognizes four classifications of confidential information. These are: (1) Business Confidential, (2) Enforcement Sensitive, (3) Enforcement Confidential, and (4) National Security Classification. Each is described below.

Business Confidential--The environmental statutes specify EPA reporting and recordkeeping requirements which in turn protect trade secrets and business confidential information. However, EPA is extremely reluctant to accept this type of information unless it is necessary for carrying out Agency functions under these Acts.

In compliance with EPA regulations, an Agency request for Company information, pursuant to statutory authority, will contain a statement allowing the facility to designate all or part of the information requested by the Agency as business confidential by marking it according to Title 40 of the Code of Federal Regulations (CFR), Part 2, Subpart B, Sections 2.201-2.309 [41 Federal Register (FR) 36902, September 1, 1976, as amended in 43 FR 39997, September 8, 1978]. In addition to citing the appropriate regulation(s), the request should state that:

1. The business may, if it desires, assert a business confidentiality claim covering part or all of the information in the manner described by 40 CFR 2.203(b), and that information covered by such a claim will be disclosed by EPA only to the extent, and by means of the procedures, set forth in those regulations; and that

2. If no such claim accompanies the information when it is received by the EPA, it may be made available to the public by EPA without further notice to the business.

When conducting a plant evaluation, inspection, or reconnaissance, field personnel should not accept business confidential information unless it is essential in performing their responsibilities. When inspectors expect to obtain or observe business confidential information, they should maintain a separate logbook. When business confidential information is entered into an inspector's logbook, the entire book and the portions containing the business confidential information are marked. In those limited situations, the Company should be requested to provide the Agency with a written statement identifying the material which is entitled to business confidential treatment. In addition, reasons must be given to substantiate the claim, including any supportive technical data or legal authority. By statute, effluent and emission data are not business confidential. Any business confidential information received in the mail or hand-delivered shall be marked Business Confidential and handled appropriately as outlined in the document control program.

A separate, locked file is maintained for the segregation and storage of all business confidential and trade-secret information. Upon receipt by the team this information is directed to and recorded in the Business Confidential Inventory Log by the Document Control Officer (DCO). The information is then made available to EPA personnel on a "need-to-know" basis, but only after it has been logged out. The information should be returned to the locked file at the conclusion of each working day unless the employee can guarantee its security. Business confidential information may not be reproduced except upon approval by and under the supervision of the DCO. Any reproduction should be kept to an absolute minimum. The DCO will enter all copies into the document control system and apply the same requirements as for the original. In addition, this information may not be entered into any computer or data handling system. Business confidential documents may not be destroyed except upon approval by and under the supervision of the DCO. The team leader will be notified prior to destruction of business confidential information. The DCO shall remove and retain the cover page of any business confidential information disposed of for one year and shall keep a record of the destruction in the Business Confidential Inventory Log.

Enforcement Sensitive--As defined by the Office of Enforcement Counsel-Monitoring (OEC-M) materials considered to be enforcement sensitive include but are not limited to:

- Documents* discussing the strengths or weaknesses of the government's or the opposing party's legal position.
- Documents discussing the strengths or weaknesses in the government's evidence or the strategy and scope of efforts for gathering of such.
- Documents listing the names of potential witnesses and/or describing other evidentiary material prior to discovery.
- Documents discussing the strategy to be employed in litigation and the timetable.
- Documents discussing negotiation or settlement strategy, including dollar amounts.

A number of documents have already been designated "enforcement sensitive" by the Office of Enforcement Counsel-Monitoring. When in the judgment of a member of the Office of Solid Waste and Emergency Response (OSWER) staff, a document is believed to be potentially "enforcement sensitive," the document (or other material) is to be submitted to the Director of the Office of Waste Programs Enforcement (OWPE). The OWPE Director will then forward the document to the Associate Administrator for OEC-M and to the General Counsel, requesting a determination as to the "enforcement sensitive" nature of the material. OEC-M, in consultation with the Department of Justice, will be the office responsible for designating materials as "enforcement sensitive." No one else may apply such a designation. However, such materials will be labeled "enforcement confidential" by the OWPE while the OEC-M is considering whether the material is "enforcement sensitive."

All OSWER "enforcement sensitive" materials will be stored in a safe located in OWPE. Each "enforcement sensitive" document will be so stamped at the bottom of each page of the document. Where the material is not a written document (such as a Lexitron disk or a tape) the jacket should be stamped "enforcement sensitive."

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*Note: The term "document" includes books, records, correspondence, memoranda, papers, notes, computer printouts, tapes, floppy disks, evidence and similar material. It covers originals, drafts, duplicates and copies. Materials may be handwritten, printed, or machine encoded.

No materials designated "enforcement sensitive" are to be retained anywhere in the OSWER outside the designated secured area without the written consent of the OWPE Director.

All "enforcement sensitive" materials will be placed in red folders. A complete list of all materials contained in a particular folder shall be placed in the folder. They will be grouped according to the enforcement case.

Access to these materials will be on a need-to-know basis. Assuming most if not all such materials will relate to specific open enforcement cases, the OWPE Regional Coordinator, in consultation with an attorney will determine immediately, or in the future as soon as a new case is opened, who should have routine access to enforcement sensitive materials associated with that case. This "routine access" list must be approved by the OWPE Director designee. Once that approval is given, persons on the approved list will be able to access the "enforcement sensitive" files through the procedures outlined below. No one else may access the files without the instance-by-instance approval of the OWPE Director.

Access to the "enforcement sensitive" files will be controlled by the secretary to the OWPE Deputy Director. He/she will maintain a log which will include a complete listing of materials within the safe, and space for time (day and hour) dated sign-out and sign-in of "enforcement sensitive" materials. Procedures will be established for including such information as the handling of the materials by those who check them out, or whether the materials were shown to anyone else, and whether they were xeroxed.

Word processor disks on which material determined to be "enforcement sensitive" is stored must also be retained in the safe. Any office or person whose duties include development of such materials should identify a disk which will be solely dedicated to storage of "enforcement sensitive" materials.

Enforcement Confidential--This is an internal Office of Solid Waste and Emergency Response designation for those documents whose security should be assured. Enforcement confidential materials include but are not limited to:

- Materials proposed for classification as enforcement sensitive but not yet formally designated.
- Scientific documents which have not yet had a peer review.
- Preliminary working papers or analyses whose disclosure might cause confusion or unnecessary public concern.
- Data which have not as yet been evaluated or analyzed.
- Internal memoranda expressing the personal views of various staff from the agency whose disclosure may be harmful to open exchange within EPA.

In general these are materials which, if disclosed, may impair the Agency's ability to freely and fully initiate or prosecute an enforcement action. It is crucial that all parties understand that all cases may eventually go to trial, and therefore, case material must be handled accordingly.

The protection afforded "enforcement confidential" materials will be much less rigorous than that for "enforcement sensitive" materials. All "enforcement confidential" materials must be kept in bar-locked files, or equally secure areas. The OWPE Director or designee should inspect and approve such file areas. Files may be kept in individual offices or work areas. A complete listing of "enforcement confidential" materials must be compiled for each case. This listing is to be maintained, and a copy retained, by the person in possession of the file. A copy of the listing should also be kept by the Chiefs, Compliance and Technical Support Branches, and the Secretary to the Deputy Director who will maintain the "enforcement sensitive" files.

National Security Confidential--The United States Government classifies certain materials as confidential in order to protect National security. This classification system has four designations:

1. For Official Use Only (FOUO)

2. Confidential

3. Secret

4. Top Secret

Higher classification status also exists, but those documents are never handled by EPA. For a complete description of this system refer to the Department of Defense.

Team Files--

After the team has completed its work for a particular investigation, all documents generated from that project should be assembled in the team file. Individuals may retain clean (no handwritten comments) copies of documents for their personal files only after personally verifying that the original or similar copy is in the team file. Documents that have been declared "Confidential" may not be retained in personal files. The team leader is responsible for assuring the collection, assembly, and inventory of all documents relative to a particular project at the time the project objectives are completed. The file then becomes accountable. Any records leaving the file must be signed out.

Evidentiary File--

When the team has completed the project objectives, all inventoried file documents are reviewed and submitted to the Document Control Officer. By this time each document will have been labeled with a unique serialized number as specified above. The Evidentiary File is formatted according to document classes. A typical format is illustrated below.

A. Project Plan
B. Project Logbooks
C. Field Data Records
D. Sample Identification Documents
E. Chain-of-Custody Records
F. Sample Receipt Forms
G. Correspondence
    1. Intra-office (Contractor)
    2. EPA
    3. Industry
    4. Record of Confidential Material
H. Report Notes, Calculations, etc.
I. References, Literature
J. Sample (on-hand) Inventory
K. Check-out Logs
L. Litigation Documents
M. Miscellaneous - photos, maps, drawings, etc.
N. Final Report

Once deposited in the Evidentiary File, documents may only be checked out through the Document Control Officer.

Reports--

All draft reports are dated and numbered and are accountable. They are stamped in red DRAFT REPORT FOR AGENCY REVIEW ONLY, DO NOT DUPLICATE on the cover page. If reports are for enforcement cases they are further labeled as "Enforcement Confidential" unless a case attorney assigns a higher classification. All draft copies of the report are to be returned to the author. Once comments have been incorporated and the final report has been prepared, all draft copies are destroyed.

Evidence Audits--

Evidence audits may be conducted by Regional or Headquarters personnel, NEIC, or by a Contractor Evidence Audit Team (CEAT) which is located in Denver, Colorado. Evidence audits will be structured around the "Field Investigations Audit Checklist" and "Document Control Audit Checklist" (Appendix A). Evidence audits may examine procedures and records, at the field site, laboratories, Regional Offices, or combinations thereof. (See "NEIC Procedures Manual for the Evidence Audit of Enforcement Investigations by Contractor Evidence Audit Teams," September 1981).

QUALITY ASSURANCE

General

The purpose of this Section is to provide general guidelines which address the quality assurance procedures applicable to the evaluation of hazardous waste sites. Due to the complex composition and heterogeneous nature of many hazardous waste materials, these guidelines cannot discuss every possible situation which may be encountered in the field or laboratory. Consequently, they are designed to encourage personnel involved in hazardous waste investigations to give adequate thought and sufficient planning to quality assurance measures, techniques and procedures before initiating a field investigation.

Decisions concerning the control and management of hazardous wastes or the need for enforcement actions must be based on analytical data generated in Agency, State, or contractor laboratories. Such management decisions will be no better than the data upon which they are based, therefore, it is imperative that the quality of the data be assured. Obtaining quality data, data which are scientifically and legally defensible, and which have the requisite levels of precision and accuracy with minimum expenditures of resources, requires the development and implementation of comprehensive and well documented quality assurance (QA) program. Decisions concerning sampling site selection, the frequency of sampling, the number of samples to be collected, the procedures involved in the collection, preservation and transport of samples, the calibration and maintenance of instruments, and the processing, verification and reporting of the data must incorporate the concepts outlined in the quality assurance program. If careful attention is not paid to these concepts, the possibility of producing invalid data is highly probable. Such data wastes resources, leads to bad management decisions, and confounds enforcement actions. Management personnel and/or their representatives will coordinate the QA program through the team leader.

Organization and Personnel

Management personnel must have a firm commitment to the production of quality data and to quality performance by all employees. Moreover, this commitment to quality must be demonstrated by management and transmitted to all of the personnel involved in an investigation or study.

Management is responsible for maintaining the resume and job description of each person involved in the design, supervision, conduct or analysis of any study or test involving hazardous waste. Such records should be maintained for a period of 3 years following completion of any hazardous waste investigation. This is important because resume and job descriptions are generally used in enforcement actions to demonstrate the competency, training, and experience, of the personnel who performed the studies under investigation.

Quality Assurance Program

Quality Assurance Plan-Scope--

The EPA agency-wide quality assurance policy states that every monitoring and measurement project must have a written and approved Quality Assurance

Project Plan. As defined, the QA project plan is a written document which presents, in specific terms, the policies, organization, objectives, functional activities, and specific QA and Quality Control (QC) activities designed to achieve the data quality goals of a specific project or continuing operation. Requirements call for a separate QA plan to be prepared for each specific project or continuing operation (or group of similar projects or continuing operations). It may be prepared as a section or an appendix of a project specific technical plan (see Section 7) or as a stand alone document. The plan should specify measurement activities and procedures which will be used to document and report precision, bias, representativeness, and completeness of environmental measurements. It provides a line of communication for a given project which will assist management personnel in maintaining a record of progress as well as an idea of the extent of any QA deficiencies that might exist.

All Quality Assurance Project Plans must be prepared in accordance with "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," QAMS-005/80, December 29, 1980 prepared by the Office of Monitoring Systems and Quality Assurance. In general, this specifies that the document must be prepared using a document control format consisting of information placed in the upper right hand corner of each page. This information should consist of:

- Section Number
- Revision Number
- Date (of Revision)
- Page

It also specifies that the plan must address the following 16 essential elements:

1. Title page with provision for approval signatures
2. Table of contents
3. Project description
4. Project organization and responsibility
5. QA objectives for measurement data in terms of precision, accuracy, completeness, representativeness and comparability
6. Sampling procedures
7. Sample custody
8. Calibration procedures and frequency
9. Analytical procedures
10. Data reduction, validation and reporting

11. Internal quality control checks and frequency

12. Performance and system audits and frequency

13. Preventive maintenance procedures and schedules

14. Specific routine procedures to be used to assess data precision, accuracy and completeness of specific measurement parameters involved

15. Corrective action

16. Quality assurance reports to management

Responsibilities--

Intramural Projects--Each Project Officer working in close coordination with the QA Officer is responsibile for the preparation of a written QA Project Plan for each intramural project that involves environmental measurements. This written plan must be separate from any general plan normally prepared for the project. The Project Officer and the QA Officer must ensure that each intramural project plan contains procedures to document and report precision, bias, representativeness, accuracy and completeness of all data generated.

Extramural Projects--Each Project Officer working in close coordination with the QA Officer has the responsibility to see that a written QA Project Plan is prepared by the extramural organization for each project involving environmental measurements. The elements of the QA Project Plan must be separately identified from any general plan normally prepared for the project. The Project Officer and the QA Officer must ensure that each extramural project plan contains procedures to document and report precision, bias, representativeness, and completeness of all data generated.

Plan Review, Approval and Distribution--

Intramural Projects--Each QA Project Plan must be approved by the Project Officer's immediate supervisor and the QA Officer. Completion of reviews and approvals is shown by signatures on the title page of the plan. Environmental measurements may not be initiated until the QA Project Plan has received the necessary approvals, unless emergency response is necessary. A copy of the approved QA Project Plan will be distributed by the Project Officer to each person who has a major responsibility for the quality of measurement data.

Extramural Projects--Each QA Project Plan must be approved by the funding organization's Project Officer and the QA Officer. In addition, the extramural organization's Project Manager and responsible QA official must review and approve the QA Project Plan. Completion of reviews and approvals is shown by signatures on the title page of the plan. Environmental measurements may not be initiated until the QA Project Plan has received the necessary approvals. A copy of the approved QA Project Plan will be distributed by the extramural organization's Project Director to each person who has a major responsibility for the quality of the measurement data.

Data Generation

All data generated, except those that are generated as direct computer input, must be recorded directly, promptly, legibly and indelibly, and the data entries must be signed and dated on the day of entry. Any change in entries must be made so as to avoid obscuring the original entry, the reason for such change must be stated, and the change and statement must be dated and signed or identified at the time of the change.

Data Processing

To prevent introducing errors or losing or misinterpreting the data, adequate precautions must be taken during the reduction and storage of data.

1. Checks will be made at data handling points between the analysts determining the data values and the individual entering the data into the data storage system.
    - All data must be recorded clearly and accurately in field logbooks or on laboratory data sheets.
    - All data must be transferred and reduced from field logbooks and bench sheets completely and accurately.
    - All field and bench records will be retained in permanent files.
    - Whenever possible, data will be organized into standard formats.
2. A data storage and information system will be capable of:
    - Receiving all entered data:
    - Screening and validating data to identify and reject outliers or errors;
    - Preparing, sorting, and entering all data into the data storage files (which are either computerized or manual); and
    - Providing stored data points with associated QA/QC "labels" which can indicate the level of confidence or quality of the data. These labels should possess the capability of:
        - indicating what QA/QC activities were included in the major steps of the monitoring process;
        - quantitatively describing the precision and bias of the analysis; and
        - making data available to users as required. Specific requirements and procedures for the above aspects of data processing will be described in Standard Operating Procedures.

Data Quality Assessment

The quality of measurement data generated and processed will be assessed for precision, bias, representativeness, comparability, and completeness based on Standard Operating Procedures and available external measures of quality (e.g., audit materials).

EPA-approved and/or best available methodology will be used for data quality assessment.

Aspects of data quality which will be addressed are:

- Precision--Standard Operating Procedures will contain a mechanism for demonstrating the reproducibility of each measurement process. Examples of activities to assess precision are: replicate samples, colocated monitors, and instrument checks.
- Bias--Standard Operating Procedures will contain mechanisms for demonstrating the systematic error of the measurement system.
- Traceability of Instrumentation--Each measurement device will be assigned a unique identification record indicating where and when used, maintenance performed, and the equipment and standards used for calibration.
- Traceability of Standards--Standards and each measurement device will be calibrated against a standard of known or higher accuracy; when possible, calibration standards will be traceable to available standards of the National Bureau of Standards (NBS). If NBS standards are not available, other available validated (primary) standards will be used.
- Traceability of Data--Data will be documented to allow complete reconstruction, from initial field records through data storage system retrieval.
- Methodology--If available, Federal reference, equivalent, or approved alternate test methods will be used. Other methodology must be fully documented and justified.
- Reference or Spiked Samples--Recoveries shall be within predetermined acceptance limits. Unacceptable recoveries are identified and documented.
- Performance Audits--As per the EPA Performance Audit Programs.
- Representativeness, Comparability, Completeness--Where appropriate, statements on representativeness, comparability, and completeness will be included.

Report Preparation

A final report must be prepared for each investigation, including the following:

- the names of the team leader, scientists, professionals, and technical support personnel involved in the inspection of investigation;
- the objectives and procedures stated in the approved study plan, including any changes from the original study plan;
- sampling site identification and description information available at the beginning of the investigation as to the nature and composition of the hazardous waste;
- a description of the methods and instrumentation, if any, used in the investigation;
- any deviations from the methods described in the approved study plan, the reasons for the deviation and their impact on the results;
- a description of the quality control methods used to ensure the quality of the data; and
- a description of all circumstances that may have affected the quality or integrity of the data.

The team leader is responsible for the final report. Corrections or additions to a final report shall be written as an amendment by the team leader.

Retention and Retrieval of Samples, Records and Data

Until transferred to the Deputy Project Officer or Document Control Officer, all preliminary data, documentation, study plans, protocols, and final reports shall be retained under storage conditions that minimize deterioration and facilitate retrieval. An individual shall be identified as responsible for the stored material, and only authorized personnel shall have access to it.

Raw data, documentation, protocols, and final reports must be retained by the Document Control Officer for at least 3 years after the completion of the final report.

Due to the varied considerations involved in establishing a QA plan (relevant to each particular investigation) a general bibliography is provided here, rather than at the end of this volume, in hopes that this will better assist and expedite the process formulation.

Additional Sources of Information

General Quality Assurance--

1. U.S. EPA (1976). "Quality Assurance Handbook for Air Pollution

Measurement Systems," EPA-600/9-76-005.

2. U.S. EPA (1973). "Quality Control Practices in Processing Air Pollution Samples," APTD 1132.
3. Juran, J. M., ed. (1974). "Quality Control Handbook," McGraw-Hill.
4. Inhorn, S. L., ed. (1978). "Quality Assurance Practices for Health Laboratories," American Public Health Association.
5. U.S. EPA (1979). "Handbook for Analytical Quality Control in Water and Wastewater Laboratories," EPA-600/4-79-019.
6. U.S. EPA (1980). "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," QAMS-005/80.

Laboratory Facilities and Practices--

1. U.S. EPA (1978). "Manual for the Interim Certification of Laboratories Involved in Analyzing Public Drinking Water Supplies- Criteria and Procedures," EPA 600/8-78-008.
2. Bicking, C., Olin, S., and King, P. (1978). "Procedures for the Evaluation of Environmental Monitoring Laboratories," U.S. EPA, EPA 600/4-78-017.

Sample Collection and Analysis--

1. U.S. EPA (1977). "Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities," EPA 530/SW-61.
2. U.S. EPA (1979). "Quality Assurance and Quality Control Procedures for Screening and Verification of Industrial Effluents for Priority Pollutants."
3. U.S. EPA (1974). "Compliance Monitoring Procedures," EPA 330/1-74-002.
4. Brownlee, K. A. (1965). "Statistical Theory and Methodology in Science and Engineering," John Wiley and Sons, Inc.

RESPONSES TO REQUESTS FOR INFORMATION

EPA Policy

The EPA policy concerning the release of information to the public aims to make information about EPA and its work available, freely and equally, to all individuals, groups, and organizations. This policy does not extend to information relating to potential enforcement actions, to evidence, or to confidential data. When information is requested, personnel should immediately notify their supervisor and/or legal counsel.

Media Contacts--

Personnel should cooperate with representatives of the press, other communications media, and interested groups. Information concerning the Agency's responsibiltiy for inspections and investigative activities can be given. Questions concerning investigations of hazardous waste sites and enforcement policy should be referred to the Office of the Regional Counsel for response.

Disclosure of Official Information--

Requests, either written or oral, for inspection or disclosure of investigatory records or confidential information, even those made under judicial discovery procedures or the Freedom of Information Act, should be immediately referred to the Regional Counsel to obtain approval prior to the release of information. Other information disseminated outside the Agency will be directed through the appropriate Regional Office or Headquarters.

ENTRY

Various Federal environmental statutes grant EPA enforcement personnel authority to enter and inspect facilities. The authority granted in each statute is similar to that stated below, from Section 308 of the Clean Water Act:

> "(a)(B) the Administrator or his authorized representative, upon presentation of his credentials -
>
> (i) shall have a right of entry to, upon, or through any premises in which an effluent source is located or in which any record required to be maintained. . . are located, and
>
> (ii) may at reasonable times have access to and copy any records, inspect any monitoring equipment or method required . . ., and sample any effluents which the owner or operator of such source is required to sample . . . ."

For the specific requirements on conducting inspections and collecting data pursuant to other particular Acts, see: Section 114 of the Clean Air Act; Sections 8 and 9 of the Federal Insecticide, Fungicide, and Rodenticide Act; Section 3007 of the Resource Conservation and Recovery Act; Sections 8 and 11 of the Toxic Substances Control Act; Section 1445 of the Safe Drinking Water Act; and Section 104 of the Comprehensive Environmental Response, Compensation and Liability Act.

Section 3007(a) of RCRA and 104(e) of CERCLA authorize the Administrator of duly designed officials to have access to and to copy all records to such wastes and substances.

"For the purpose of developing or assisting in the development of any regulations or enforcing the provision of this title, such officers, employees or representatives are authorized--

- "to enter at reasonable times any establishment or other place where hazardous wastes are or have been generated, stored, treated, disposed of or transported from"; and

- "to inspect and obtain samples from any person of any such wastes and samples of any containers or labeling for such wastes".

Unless a warrant has been obtained, inspections must be made with the consent of the owner/operator or other person so authorized. The following general rules are concerned with gaining consent.

- Official agency credentials must be presented to the plant representative authorized to give consent to an inspection of the facility.
- Consent must be given by the owner of the premises or the person in charge of the premises at the time of the inspection. The name of the person giving consent, the time and date of the consent should be noted in the field log. Consent must be requested for photography if it is part of the investigation. See Section 5, Photographs.
- Consent must be secured without any behavior which could be characterized as coercive (either in a verbal or physical sense), such as threats of punitive action.
- Consent to the inspection may be withdrawn at any time. That segment of the inspection completed before the withdrawal of consent remains valid. Withdrawal of consent is equivalent to refused entry. A warrant should be secured to complete the inspection.
- Consent is not required for observation of things that are in plain view, i.e., that a member of the public could be in a position to observe, including observations made while on private property in areas that are not closed to the public; e.g., matters observed while the inspector presents his credentials. However, access to any portion of the facility to an inspector without a warrant may be limited at the descretion of the owner of the facility.
- Consent may be given with "conditions". When such "conditional" consent is proposed, guidance should be sought from the appropriate Regional authority, prior to further activity. "Conditions" must be accurately recorded.

If denied entry after the appropriate procedural steps have been followed, ask the person the reason for denying entry and record the response in the field logbook along with the date, time, and person's name. All events surrounding the refused entry should be documented. Also, note such observations about the appearance of the facility as are possible. Then contact the Office of Regional Counsel at the Regional Office for instructions.

Warrants

In the event that entry is denied or consent withdrawn, the Regional Counsel must be contacted. Normally the Regional Counsel will take the necessary actions to secure three separate documents and submit them to the judge of magistrate in order to obtain a warrant, viz:

Application for a Warrant--

- Statement of statutory and regulatory authority for the warrant.
- Identification of the site or establishment desired to be inspected (and, if possible, the owner and/or operator of the site).
- Summary of the factual background for the warrant as stated in the affidavit.

Affidavit--

- The affidavit should contain consecutively numbered paragraphs which provide detailed descriptions of the facts which support the issuance of a warrant.
- The factual description should recite or incorporate the specific probable cause or neutral administrative scheme which led to the particular establishment's selection for inspection.
- The affidavit must be signed by a person with personal knowledge of all the facts contained therein (in refused entry proceedings, this person would most likely be the inspector denied entry).
- An affidavit is a sworn statement which, therefore, must be either notarized or personally sworn before the magistrate or judge.

Draft Warrant--

The content of the warrant varies depending on the type of warrant sought (discussed below). The warrant should be submitted in such a form that the judge or magistrate merely has to sign it to make it valid.

- Civil specific probable cause warrants are based on some specific reason to believe that the requirements of the statute or regulations are being violated. A civil warrant should be sought only where it can be accurately stated in the affidavit that the purpose of the inspection is to find and remedy the statutory violation through noncriminal proceedings. Therefore, this warrant will be used when the inspection is being made in response to the discovery of a potential or actual violation from another source; i.e., a citizen's complaint or through the report screening process. If possible, such a warrant should be obtained rather than a civil probable cause warrant (discussed below).
- Civil probable cause warrants are based on neutral administrative inspection scheme; i.e., showing that "reasonable legislative or administrative standards for conducting an . . . inspection are satisified with respect to a particular establishment.", Marshal v.

Barlow's Inc., 436 U.S. 307, 90 S. Ct. 1816 (1978). A warrant based on a neutral administrative process can be issued only if the facility for which the warrant is sought was selected for inspection through this neutral process. Therefore, this type of warrant may be used for regularly scheduled inspections; e.g., annual inspections, post closure inspection, etc.

- Criminal warrants are obtained when the purpose of the inspection is to gather evidence for a criminal prosecution in accordance with Rule 41 of the Federal Rules of Criminal Procedure. This type of warrant requires a specific showing of probable cause to believe that evidence of a crime will be discovered. It should be noted that, ordinarily, evidence of a criminal violation inadvertently discovered under a civil probable cause warrant will be admissible in court. Therefore, a criminal warrant will be used only where the Agency is reasonably certain that criminal violations have occurred and that a search will produce evidence of a crime.

Securing a Warrant--

The following procedures should be followed in securing a warrant:

- When an inspector is refused entry, the inspector should leave the premises immediately.

- The inspector should then immediately contact the designated Regional Counsel to inform him/her of the situation. The inspector should at this time report any exigent conditions and clearly specify the time frame required for the inspection. Normally a warrant will specify that entry can occur only during reasonable hours (typically 8 a.m. to 5 p.m.) and may be limited to a single specified day. If the inspection will require additional days or extended operational hours the counsel and the judge should be informed so that the warrant will reflect those actions necessary to complete the investigation. Once the time limit has expired the investigators cannot enter the premises.

- The Regional Counsel will assist the inspector in the preparation of the necessary documents.

- The Regional Counsel will arrange for a meeting with the inspector and a U.S. Attorney. The inspector will bring a copy of the appropriate draft warrant and affidavits.

- The Enforcement attorney should inform the appropriate Headquarters Office of Legal Counsel of any refusals to enter and send a copy of all papers filed to Headquarters.

- The attorney will then secure the warrant and forward it to the inspector and/or the U.S. Marshall.

Inspections with a Warrant should Comply with the Following--

- Use of Warrant to Gain Entry

- If there is a high probability that entry will be refused even with a warrant or where there are threats of violence, the inspector should be accompanied by a U.S. Marshall.

- The inspector should never himself attempt to make any forceful entry of the establishment.

- If entry is refused to an inspector holding a warrant but not accompanied by a U.S. Marshall, the inspector should leave the establishment and inform the Deputy Regional Counsel.

- Conducting an Inspection

  - The inspection must be conducted strictly in accordance with the warrant. If the warrant restricts the inspection to certain areas of the premises or certain records, those restrictions must be adhered to.

  - If sampling is authorized, all procedures must be carefully followed including presentation of receipts for all samples taken. The facility should also be informed of its right to retain a portion of the samples obtained by the inspector.

  - If records of property are authorized to be taken, the inspector must provide receipts and maintain a written inventory, directly on the warrant, of all items removed from the premises.

Procedure to be Followed Upon Completion of the Inspection--

1. Whoever executed the warrant must sign the Return-of-Service form indicating on whom the warrant was served and the date served.

2 A copy of the warrant must be left with the person to whom the warrant was served.

3. The executed warrant must be submitted to the U.S. Attorney for formal return to the issuing magistrate or judge.

4. An inventory of any items which were taken from the premises must be listed on the warrant and submitted to the court, and the inspector must be present to certify that the inventory is accurate and complete.

ZONE CONTRACTS

Zone and Nationwide Support Contracts

The EPA has initiated a number of procurements on a national level which provide for Architectural/Engineering, cleanup/removal and enforcement assistance in support of hazardous waste site investigations and remedial actions. Access to these services is usually initiated at the regional level and generally proceeds from a designated regional official (e.g., regional contract project officer, site project officer, contracting officer) through EPA headquarters and on to the designated contractor. The contractor will then respond with a work plan type document, including their estimate of budget and schedule. Upon approval of the work plan, the assignment or technical directive will be initiated.

Obviously the procedures to be actually followed are much more complex than indicated in the above generic description, but it is far beyond the scope (and need) for each of the individual contract parameters to be described in this document. In addition, the exact nature of the tasks allowed under each contract as well as the number of such contracts awarded is subject to future change, and a detailed explanation here might only serve to confuse the issue. This description is therefore meant to merely recognize the existence of these contract mechanisms, and it is recommended that the appropriate regional office, and more specifically the regional contract project officer, be contacted for details concerning the support contract in question.

SECTION 3

SAFETY

INTRODUCTION

A major concern during hazardous waste site investigations is safety, both for the general public and the site investigators. This section is intended as an introductory overview of safety concerns and practices summarizing some of the major safety issues and procedures. A more detailed discussion of the provisions and requirements of a hazardous waste site Health and Safety Plan is provided in other documents prepared by EPA.*

POLICY AND RESPONSIBILITY

The EPA is committed to providing all EPA employees with a safe and healthy work environment at hazardous waste sites. The Assistant Administrators and Regional Administrators have ultimate responsibility for health and safety programs. Officers in Charge of Reporting Units (OICs) are responsible for implementing health and safety programs. The Occupational Health and Safety Designee advises and assists the OIC to develop, organize, direct, and evaluate health and safety programs and coordinates all recordkeeping activities. The Project Officer has the responsibility for preparing site specific safety plans for hazardous waste sites and serving as a liaison between the Occupational Health and Safety Designee and the Site Safety Officer. Although the Project Officer selects the Site Safety Officer who is responsible for day-to-day implementation of the site-specific health and safety plan, the Site Safety Officer will be charged with implementing administrative policy for field work specific to the site as determined by the above personnel and agency committees. Ideally, the Site Safety Officer will report to the Occupational Health and Safety Designee rather than the Project Officer, to avoid conflicts due to logistics or work schedules. EPA employees are responsible for complying with the health and safety program established for hazardous waste site investigations.

Exposure to Toxic Substances

Toxic or chemically active substances present a special situation because they can be inhaled, ingested, absorbed through the skin, or destructive to the skin. They may exist in the air or, due to site activities, become airborne or splash on the skin. Ingested or inhaled, the substances can cause no apparent illness or they can kill. On the skin they can cause no demonstrable effects, they can damage the skin, or they can be absorbed, leading to systemic poisoning.

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*Refer to Interim Standard Operation Safety Guides, revised September 1982, U.S. Environmental Protection, Office of Emergency and Remedial Response (OERR). Also Guidance Manual for Protection of Health and Safety At Uncontrolled Hazardous Substances Sites, U.S. EPA, Center for Environmental Research Information (ORD) (in draft, January 1983).

Two types of potential exposure exist:

- Acute--Concentrations of toxic air contaminants are high relative to the type of substance and its protection criteria. Substances may contact the skin directly through splashes, immersion, air, etc., with serious results. Exposures are for relatively short periods of time.

- Chronic--Concentrations of toxic air contaminants are relatively low. Direct skin contact is with substances that are of low dermal activity. Exposures are over longer periods of time.

In general, acute exposure to chemicals in air is more typical in transportation accidents, fires, or releases at chemical manufacturing or storage facilities. Acute exposures do not persist for long periods of time. Acute skin exposures occur when workers must be close to the substances in order to control the release (patching a tank car, off-loading a corrosive material, etc.) or contain and treat the spilled material. Once the immediate problems have been alleviated, exposures tend to become more chronic in nature as cleanup progresses.

Chronic exposures usually are associated more with longer-term remedial operations. Contaminated soil and debris may be involved, soil and ground water may be polluted, or containment systems may hold diluted chemicals. Abandoned waste sites generally represent chronic problems. As activities start at these sites, however, personnel engaged in sampling, handling containers, bulking compatible liquids, etc. face an increased risk of acute exposures to splashes, mists, gases, or particulates.

Acute and chronic exposures to toxic substances are one type of hazard. Other potential worker exposure hazards are materials that burn, explode, react, emit radiation, or cause disease. All can create life-threatening situations.

At any specific site, the hazardous properties of the materials present may be only a potential threat. However, the health and safety of response personnel requires that the hazards at a site - real or potential-must be characterized and appropriate preventive measures instituted.

Medical Surveillance

Prior to any hazardous waste site investigation, a medical surveillance program must be developed, established, and maintained to safeguard the health of response personnel. This program has two essential components: routine health care and emergency treatment.

Routine Health Care--

Routine health care and maintenance should consist of at least:

1. Pre-employment medical examinations to establish the individual's state of health, baseline physiological data, and ability to wear personnel protective equipment. The frequency and type of examination to be conducted thereafter should be determined by medical personnel knowledgeable in the area of toxicology.

2. Arrangements to provide special medical examinations, care, and counseling in case of known or suspected exposures to toxic substances. Any special tests performed depend on the chemical substance to which the individual has been exposed.

Emergency Medical Care and Treatment--

The following items should be included in emergency care provisions:

1. Name, address, and telephone number of the nearest medical treatment facility should be conspicuously posted. A person and/or directions for locating the facility, plus the travel time, should be readily available.

2. The facility's ability to provide care and treatment of personnel exposed or suspected of being exposed to toxic (or otherwise hazardous) substances should be ascertained. If the facility lacks toxicological capability, arrangements should be made for consultant services.

3. All administration arrangements for accepting patients should be made in advance with the facility.

4. Arrangements should be made to quickly obtain ambulance, emergency, fire, and police services. Telephone numbers and procedures for obtaining these services should be conspicuously posted.

5. Emergency showers, eye wash fountains, and first aid equipment should be readily available onsite. Personnel should have first aid and medical emergency training.

6. Provisions should be made for rapid identification of the substance to which the worker has been exposed (if this has not previously been done). This information must be given to medical personnel.

EDUCATION AND TRAINING

All personnel involved in hazardous waste site investigations must be trained to carry out their response functions. Training must be provided in the use of all equipment, including respiratory protective apparatus and protective clothing; safety practices and procedures; general safety requirements; first aid; and hazard recognition and evaluation.

Safety training must be a continuing part of the total response program. Periodic retraining and practice sessions not only create a high degree of safety awareness, but also help to maintain proficiency in the use of equipment and knowledge of safety requirements.

Personnel dealing with hazardous waste sites must make many complex decisions regarding safety. To make these decisions correctly requires more than elementary knowledge. For example, selecting the most effective personnel protective equipment requires not only expertise in the technical areas of respirators, protective clothing, air monitoring, physical stress, etc., but also experience and professional judgment. Only a competent, qualified person (specialist) has the technical judgment to evaluate a particular site and determine the appropriate safety requirements. This individual, through a combination of professional education, on-the-job experience, specialized training, and continual study, requires expertise to make sound decisions.

DEVELOPMENT OF A HEALTH AND SAFETY PLAN

A Health and Safety Plan must be prepared for each waste site investigation. In practice, contractors and agencies involved in field investigations shall have a generic Health and Safety Plan from which site-specific Health and Safety Plans can be derived. This generic plan should be of sufficient detail and quality that only a few revisions would be necessary for each site.

In addition to standard operating field procedures, the Health and Safety Plan will contain information that deals specifically with the site being investigated. This plan will include any available information on the site such as known or suspected contaminants, required levels of protection, decontamination procedures, locations of the various zones of contamination, and other pertinent information or modifications to standard procedure. All personnel must be familiar with the standard operating procedures and additional instructions found in the Safety Plan.

All personnel going onsite must be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures, and communications. Emergency planning is an important part of the Health and Safety Plan. All personnel should be familiar with emergency procedures: first aid equipment; water availability; rapid notification of fire, police and emergency medical facilities; presence of transport vehicles, fire fighting equipment and extra protective equipment.

PRELIMINARY ONSITE EVALUATION

The initial onsite survey is to determine, on a preliminary basis, hazardous or potentially hazardous conditions. The main effort is to rapidly identify the immediate hazards that may affect the public, response personnel, and the environment. Of major concern are the real or potential dangers--for example, fire, explosion, oxygen-deficient atmospheres, radiation, airborne contaminants, containerized or pooled hazardous substances--that could affect workers during subsequent operations. This preliminary evaluation will be part of the Site Inspection (Section 5) as well as the Field Investigation (Section 7).

Organic Vapors and Gases

If the type(s) of organic substance(s) present at a site is known and the material is volatile or can become airborne, air measurements for organics should be made with one or more appropriate, properly calibrated survey instruments.

When the presence or types of organic vapors/gases are unknown, instruments such as a photoionization detector (HNu Systems) and/or a portable gas chromatograph flame ionization detector (Century Systems OVA), operated in the total readout mode, should be used to detect organic vapors. Until specific constituents can be identified, the readout indicates total airborne substances to which the instrument is responding. Identification of the individual vapor/gas constituents permits the instruments to be calibrated and used for more specific analysis.

Sufficient data should be obtained during the initial entry to map or screen the site for various levels of organic vapors. These gross measurements can be used on a preliminary basis to: (1) determine levels of personnel protection, (2) establish site work zones, and (3) select candidate areas for more thorough qualitative and quantitative studies.

Higher than background readings on the HNu or OVA may also indicate the displacement of oxygen or the presence of combustible vapors.

Inorganic Vapors and Gases

The ability to detect and quantify nonspecific inorganic vapors and gases is extremely limited. Presently, the HNu photoionizer has limited detection capability while the Century Systems OVA has none. If specific inorganics are known or suspected to be present, measurements should be made with appropriate instruments, if available. Colorimetric indicator tubes can be used if the identities of the substances present are known (or can be narrowed to a few) and appropriate indicator tubes are available.

Radiation

Although radiation monitoring is not necessary for all responses, it should be incorporated in the initial survey where radioactive materials may be present--for example, warehouses or hazardous material storage facilities, or abandoned waste sites.

Normal gamma radiation background is approximately 0.01 to 0.02 milliroentgen per hour (mR/hr) on a gamma survey instrument. Work can continue with elevated radiation exposure rates; however, if the exposure rate increases to 3 to 5 times above gamma background, a qualified health physicist should be consulted. At no time should work continue with an exposure rate of 10 mR/hr or above without the advice of a health physicist. EPA's Office of Air, Noise, and Radiation has radiation specialists in each Region, as well as at Headquarters; Montgomery, Alabama; and Las Vegas, Nevada, to assist.

The absence of gamma readings above background should not be interpreted as the complete absence of radioactive materials. Radioactive materials emitting lower energy alpha or beta radiation may be present, but for a number of reasons may not cause a response on the gamma survey instrument. Unless airborne, these radioactive materials should present a minimal hazard, but more thorough surveys should be conducted as site operations continue to ascertain the complete absence of all radioactive materials. See Section 5, Volume II - Available Sampling Methods.

Oxygen Deficiency

At sea level, ambient air must contain at least 19.5 percent oxygen by volume to be considered safe for personnel. At lower percentages, air-supplied respiratory protective equipment is needed. Oxygen measurements are of particular importance for work in enclosed spaces, low-lying areas, or in the vicinity of situations that have produced heavier-than-air vapors which could displace ambient air. These oxygen-deficient areas are also prime locations for taking further organic vapor and combustible gas measurements, since the air has been displaced by other substances. Oxygen-enriched atmospheres are considered dangerous due to the increased potential for fires.

Combustible Gases

The presence or absence of combustible vapors or gases must be determined. If readings approach or exceed 10 percent of the lower explosive limit (LEL), extreme caution should be exercised in continuing the investigation. If readings approach or exceed 25 percent LEL, personnel should be withdrawn immediately. Before resuming any onsite activities, project personnel in consultation with experts in fire or explosion prevention must develop procedures for continuing operations.

Visual Observations

While onsite, the initial entry team should make visual observations which would help in evaluating site hazards--for example, dead fish or animals or stressed vegetation; land features; wind direction; labels on containers indicating explosive, flammable, toxic, or corrosive materials; conditions conducive to splash or contact with unconfined liquids, sludges, or solids; and other general conditions.

Direct-Reading Instruments

A variety of toxic air pollutants, (including organic and inorganic vapors, gases, or particulates) can be produced or released at hazardous waste sites. Direct-reading field instruments will not detect or measure all of these substances. Thus, negative readings should not be interpreted as the complete absence of airborne toxic substances. Verification of negative results can only be done by collecting air samples and analyzing them in a laboratory.

STANDARD ONSITE SAFETY PRACTICES

The team leader is responsible for establishing, and adjusting as necessary, safety precautions appropriate to the individual hazardous waste site being evaluated, such as the use of self-contained breathing apparatus, etc. The team leader ensures that all participants conduct their work in accordance with the project Health and Safety Plan and applicable rules. The team leader is authorized to direct any employee to leave the site if the employee fails to observe safety requirements or in any way creates a safety hazard.

Personnel Precautions

Personnel precautions include the following:

1. Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated.
2. Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking, or any other activities.
3. Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.
4. No excessive facial hair which interferes with a satisfactory fit of the mask-to-face seal is allowed on personnel required to wear respiratory protective equipment.
5. Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, don't walk through puddles, mud, and other discolored surfaces; kneel on ground; lean, sit, or place equipment on drums, containers, vehicles, or the ground.
6. Medicine and alcohol can potentiate the effects of exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on response operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Alcoholic beverage intake should be minimized or avoided during response operations.
7. There is an increased potential for fatigue and/or heat prostration when wearing protective garments (due to dehydration, etc.).

Onsite Regulations

Onsite regulations include:

1. Entrance and exit must be planned and emergency escape routes delineated. Warning signals for site evacuation must be established.

2. Personnel should practice unfamiliar operations prior to implementing the actual procedure.

3. Personnel onsite must use the "buddy" system when wearing respiratory protective equipment. As a minimum, a third person, suitably equipped as a safety backup, is required during initial entries.

4. During continual operations, onsite workers act as safety backup to each other. Offsite personnel provide emergency assistance.

5. Communications using radios or other means must be maintained between initial entry members at all times. Emergency communications should be prearranged in case of radio failure, necessity for evacuation of site, or other reasons.

6. Visual contact must be maintained between "pairs" onsite and safety personnel. Entry team members should remain close together to assist each other during emergencies.

7. Wind indicators visible to all personnel should be strategically located throughout the site.

8. Ambient air must be monitored at regular intervals, either for total vapor readings or for known or suspected specific contaminants.

Unsafe Situations

All employees are directed to bring to the attention of the most readily accessible supervisor any unsafe condition, practice, or circumstance associated with or resulting from hazardous waste site investigations.

In cases of immediate hazard to employees or the public, any employee on the scene should take all practicable steps to eliminate or neutralize the hazard; this may include leaving the site. Followup consultation with the team leader or on-scene supervisor must then be made at the first opportunity. In such circumstances the team leader or supervisor must take, or cause to be taken, the necessary steps to ensure that the investigation can be completed safely. Such steps may include changes in procedure, removal or neutralization of a hazard, consultation with appropriate experts, or bringing in specialists such as Explosive Ordinance Disposal units. All such actions must be coordinated with and approved by the site management personnel. In cases where the hazard is not immediate, the employee should consult the team leader regarding appropriate corrective measures. Application of this rule requires exercising good judgment and common sense by all employees.

Safety Precautions during Sampling

Sampling methods are described in Volume II--Available Sampling Methods. As a general rule, sampling equipment used on a hazardous waste site should be disposable. Dippers, scoops, and similar devices for solids samples should be left onsite, or placed in plastic bags for disposal or later decontamination. Liquid samples from barrels or tanks should be withdrawn in inert tubing, such as glass, and the tubing should then be broken and abandoned within the barrel or tank. If incineration or recycling of barrel contents is contemplated, the tubing may be disposed of in other suitable containers or on the site. The guiding safety principle is to prevent exposure of others to spilled or residual waste materials.

Containers (drums, tanks, etc.) should only be sampled when necessary. Opening drums or other sealed containers may be hazardous to sampling personnel unless proper safety procedures are followed. Drums should be "shock-tested" before sampling. Gases can be released, or pressurized liquids can be expelled. A drum should not be removed or opened unless it can be ascertained "beyond reasonable doubt" that the drum is structurally sound. Drums standing on end, with bung up, may be opened by pneumatic impact wrench, operated from a safe distance. Drums on sides may be opened similarly if it is possible to safely rotate the drum so that the bung is high. If the bung can be removed, sampling contained liquids may be safely accomplished. Barrels that have badly rusted bungs or that cannot be sampled as above may be opened with a number of drum penetrating devices. These include hydraulic cutters, back hoe-mounted puncture spikes, or remotely operated drills. One such device, developed by the NEIC, is a hydraulic penetrating device that inserts a tap into the drum. After sampling, the tap can be disabled and left in the drum to prevent content loss.

In general, metal sample containers should not be used during hazardous waste site investigations; if used, they must be grounded, preferably to the drum or tank being sampled, while sample transfer is accomplished.

In any case where the presence of explosives is suspected or known, the investigation should be terminated and the proper authorities contacted for removal. In no event may team members knowingly handle explosives encountered on dump sites.

Subsurface sampling at a hazardous waste site can also create hazards to employees and the public unless adequate safety precautions are followed. Biodegradation of refuse in dumps produces methane and other explosive gases. The escaping gases may be ignited by drill rigs or other ignition sources. Drilling into dump sites may cause discarded incompatible substances to be mixed and thereby create reactive mixtures. Dump sites where leachate plumes are contained on impervious strata may be interconnected with producing aquifers if drilling is not planned carefully.

Drilling at hazardous waste site investigations should be confined to the periphery of the waste sites; the objective is to characterize the leachate thay may be moving away from the site. If onsite subsurface sampling is necessary, excavation should be accommplished by hand with spark-free equipment, unless detailed geophysical information (i.e., ground penetrating radar, magnetic surveys) has been obtained.

Drilling may be preceded by sweeps with metal detectors having a sensitivity to minimum depth of 10 feet, and drilling must be limited to areas where the presence of buried drums or tanks is not indicated.

Ambient air sampling on a hazardous waste site must be accomplished with spark-free equipment if explosive vapors are present (most conventional hi-vol

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samplers are spark sources). All instruments or other electronic and electrical devices employed on or around a hazardous waste site must be approved or certified as inherently safe by Underwriter's Laboratory (UL) or Factory Mutual Systems (FM) according to the provisions set forth by the National Electric Code. Portable power sources or generators should also comply with the above constraints.

LEVELS OF PROTECTION

Personnel must wear protective equipment when response activities involve known or suspected atmospheric contamination, when vapors, gases, or particulates may be generated, or when direct contact with skin-affecting substances may occur. Respirators can protect lungs, gastrointestinal tract, and eyes (when full-face respirators are used) against air toxicants. Chemical-resistant clothing can protect the skin from contact with skin-destructive and -absorbable chemicals. Good personal hygiene limits or prevents ingestion of material.

Equipment to protect the body against contact with known or anticipated chemical hazards has been divided into four categories according to the degree of protection afforded:

- Level A--Should be worn when the highest level of respiratory, skin, and eye protection is needed.
- Level B--Should be selected when the highest level of respiratory protection is needed, but a lesser level of skin protection is required. Level B protection is the minimum level recommended on initial site entries until the hazards have been further defined by onsite studies and appropriate personnel protection utilized.
- Level C--Should be selected when the type(s) of airborne substance(s) is known, the concentration(s) is measured, and the criteria for using air-purifying respirators are met.
- Level D--Should not be worn on any site with respiratory or skin hazards. This level of protection consists primarily of a work uniform providing minimal protection.

The Level of Protection selected should be based primarily on:

- Type(s) and measured concentration(s) of the chemical substance(s) in the ambient atmosphere and its toxicity.
- Potential or measured exposure to substances in air, splashes of liquids, or other direct contact with material due to work being performed.

In situations where the type(s) of chemical(s), concentration(s), and possibilities of contact are known, the appropriate Level of Protection must be selected based on professional experience and judgment until the hazards can be better characterized.

While personnel protective equipment reduces the potential for contact with harmful substances, ensuring the health and safety of personnel also requires safe work practices, decontamination, site entry protocols, and other safety considerations. Together, these protocols establish an integrated approach for reducing potential harm to workers.

Level A Protection

Personnel Protective Equipment--

Level A protective equipment briefly consists of a fully encapsulating chemical-resistant suit with pressure-demand, self-contained breathing apparatus (SCBA) approved by the Mine Safety and Health Administration (MSHA) and the National Institute of Occupational Safety and Health (NIOSH). Due to the wide variety of types, materials, construction detail, permeability, etc., a specialist should be consulted to select the most effective clothing. Known or anticipated hazards and work functions also should be considered when making this selection. This is the highest level of protection for entering a hazardous waste site.

Criteria for Selection--

Meeting any of these criteria warrants use of Level A protection:

- The chemical substance(s) has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on the following:

    - measured (or potential for) high concentration(s) of atmospheric vapors, gases, or particulates, or

    - site operations and work functions involving high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates.

- Extremely hazardous substances (for example: dioxin, cyanide compounds, concentrated pesticides, Department of Transportation Poison "A" materials, carcinogens, and infectious substances) are known or suspected to be present, and skin contact is possible.

- The potential exists for contact with substances that destroy skin.

- Operations must be conducted in confined, poorly ventilated areas until the absence of hazards requiring Level A protection is demonstrated.

- Total atmospheric readings on the Century OVA System, HNu Photoionizer, and similar instruments (Volume II) indicate 500 to 1,000 ppm of unidentified substances.

Guidance on Selection Criteria--

The fully encapsulating suit provides the highest degree of protection to skin, eyes, and respiratory system if the suit material is resistant to the chemical(s) of concern during the time the suit is worn and/or at the measured or anticipated concentrations. While Level A provides maximum protection, the suit material may be rapidly permeated and penetrated by certain chemicals from extremely high air concentrations, splashes, or immersion of boots or gloves in concentrated liquids or sludges. These limitations should be recognized when specifying the type of chemical-resistant garment. Whenever possible, the suit material should be matched with the substance it is to project against.

The use of Level A protection and other chemical-resistant clothing requires evaluating the problems of physical stress, in particular heat stress associated with the wearing of impermeable protective clothing. Response personnel must be carefully monitored for physical tolerance and recovery.

Protective equipment, being heavy and cumbersome, decreases dexterity, agility, visual acuity, etc., and so increases the probability of accidents. This probability decreases as less protective equipment is required. Thus, increased probability of accidents should be considered when selecting a Level of Protection.

Many toxic substances are difficult to detect or measure in the field. When such substances (especially those readily absorbed by or destructive to the skin) are known or suspected to be present and personnel contact is unavoidable, Level A protection should be worn until more accurate information can be obtained.

Examples of situations where Level A has been worn are:

- Excavation of soil suspected of being contaminated with dioxin.
- Handling and moving drums suspected and/or known to contain substances that were skin destructive or absorbable.

Level B Protection

Personnel Protective Equipment--

Level B personnel protective equipment briefly consists of pressure demand, self-contained breathing apparatus (MSHA/NIOSH approved), chemical-resistant clothing or coveralls with hood, chemical-resistant gloves and boots. The same level of respiratory protection is provided as in Level A, but less skin protection is provided.

Criteria for Selection--

Meeting any one of these criteria warrants the use of Level B protection:

- The type(s) and atmospheric concentration(s) of toxic substances have been identified and require the highest level of respiratory protection, but a lower level of skin and eye protection. These would be atmospheres:
  - with concentrations Immediately Dangerous to Life and Health (IDLH), or

  - exceeding limits of protection afforded by a full-face, air-purifying mask, or
  - containing substances for which air-purifying canisters do not exist or have low removal efficiency, or
  - containing substances which require that personnel wear air-supplied equipment, but substances and/or concentrations do not represent a serious skin hazard.

- The atmosphere contains less than 19.5 percent oxygen.
- Site operations make it highly unlikely that the small, unprotected area of the head or neck will be contacted by splashes of extremely hazardous substances.
- Total atmospheric concentrations of unidentified vapors or gases range from 5 ppm to 500 ppm on instruments such as the Century OVA System or HNu Photoionizer (Volume II), and where vapors are not suspected of containing high levels of chemicals toxic to skin.

Guidance on Selection Criteria--

Level B equipment provides a high level of protection to the respiratory tract, but a somewhat lower level of protection to skin. The chemical-resistant clothing required in Level B is available in a wide variety of types, materials, construction detail, permeability, etc. These factors all affect the degree of protection afforded. Therefore, a specialist should select the most effective chemical-resistant clothing based on the known or anticipated hazards and/or job function.

Generally, if a self-contained breathing apparatus is required, Level B clothing rather than a Level A fully encapsulating suit is selected, based on the protection needed against known or anticipated substances affecting the skin. Level B skin protection is selected by:

- Comparing the concentrations of known or identified substances in air with skin toxicity data.
- Determining the presence of substances that are destructive to and/or readily absorbed through the skin by liquid splashes, unexpected high levels of gases or particulates, or other means of direct contact.
- Assessing the effect of the substance (at its measured air concentrations or splash potential) on the small area of the head and neck unprotected by chemical resistant clothing.

While Level B protection does not afford the maximum skin (and eye) protection as does a fully encapsulating suit, a good quality, hooded, chemical-resistant, one-or two-piece garment, with taped joints, provides a reasonably high degree of protection. At most abandoned hazardous waste sites, ambient atmospheric gas/vapor levels have not approached concentrations sufficiently high to warrant maximum protection. In all but a few circumstances, Level B should provide the protection needed for initial entry. Subsequent operations require a re-evaluation of the level of protection based on the probability of being splashed by chemicals, their effect on the skin, or the presence of hard-to-detect air contaminants.

Level C Protection

Personnel Protective Equipment--

Level C personnel protective equipment briefly consists of chemical-resistant clothing or coveralls, with hood, and chemical-resistant gloves and boots. Respiratory protective equipment consists of a full face, air purifying respirator with an appropriate cannister or cartridges. The same level of skin protection is provided as in Level B, however the respiratory protection is limited to the air purifying respirator.

Criteria for Selection--

Meeting of all of these criteria permits use of Level C protection:

- Measured air concentrations of identified substances will be reduced by the respirator to at or below the substance's exposure limit, and the concentration is within the service limit of the canister.
- Atmospheric contaminant concentrations do not exceed IDLH levels.
- Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect the small area of skin left unprotected by chemical-resistant clothing.
- Job functions have been determined not to require self-contained breathing apparatus.
- Total vapor readings register between background and 5 ppm above background on instruments such as the HNu Photoionizer and Century OVA System (see Volume II).
- Air will be monitored periodically.

Guidance on Selection Criteria--

Level C protection is distinguished from Level B by the equipment used to protect the respiratory system, while the same type of chemical-resistant clothing is used. The main selection criterion for Level C is that conditions permit wearing air-purifying devices.

The air-purifying devices must be a full-face mask (MSHA/NIOSH approved) equipped with a canister suspended from the chin or on a harness. Canisters must be able to remove the substances encountered. Quarter- or half-masks or cheek-cartridge full-face masks should be used only with the approval of a qualified individual, primarily due to the lower breakthrough volumes and shorter service life for cartridges, and the increased risk of eye injury when using quarter or half-face masks.

In addition, a full-face, air-purifying mask can be used only if:

- Oxygen content of the atmosphere is at least 19.5 percent by volume.
- Substance(s) is identified and its concentration(s) measured.
- Substance(s) has adequate warning properties.
- Individual passes a qualitative fit-test for the mask.
- Approppriate canister/cartridge is used, and its service limit concentration is not exceeded.

An air monitoring program is part of all response operations when atmospheric contamination is known or suspected. It is particularly important that the air be monitored thoroughly when personnel are wearing air-purifying respirators (Level C). Continual surveillance using direct-reading instruments and air sampling is needed to detect any changes in air quality necessitating a higher level of respiratory protection. See Section 5 and Volume II for guidance on air monitoring.

Total unidentified vapor/gas concentrations of 5 ppm above background require Level B protection. Only a qualified individual should select level C (air-purifying respirators) protection for continual use in an unidentified vapor/gas concentration of background to 5 ppm above background.

Level C protection (full-face, air purifying respirator) should be worn routinely in an atmosphere only after the type(s) of air contaminant(s) is identified and concentrations measured. The guideline of total vapor/gas concentrationn of background to 5 ppm above background should not be the sole criterion for selecting Level C. Since the individual contributors may never be completely identified, a decision on continuous wearing of Level C must be made after assessing all safety considerations, including the following:

- The presence of (or potential for) organic or inorganic vapors/gases against which a canister is ineffective or has a short service life.
- The known (or suspected) presence in air of substances with low Threshold Limit Values (TLV) or IDLH levels.
- The presence of particulates in air.
- The errors associated with both the instruments and monitoring procedures used.
- The presence of (or potential for) substances in air which do not elicit a response on the instrument(s) used.
- The potential for higher concentrations in the ambient atmosphere or in the air adjacent to specific site operations.

Level D Protection

Personnel Protective Equipment--

Level D personnel protective equipment consists basically of work clothes and boots. It is recommended that an escape mask be carried in the event of an emergency.

Criteria for Selection--

Meeting any one of these criteria allows use of Level D protection:

- No hazardous air pollutants have been measured.
- Work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals.

Guidance on Selection Criteria--

Level D protection is primarily a work uniform. It can be worn in areas where: (1) only boots can be contaminated, or (2) there are no inhalable toxic substances.

CONTROL AT THE SITE

Activities at hazardous waste sites involving hazardous substances may contribute to the movement of materials (contaminates) from the site to unaffected areas. Response personnel working and equipment used around the substances may become contaminated and carry the material into clean areas. Material may become airborne due to its volatility, or the disturbance of contaminated soil may cause it to become wind blown. To minimize the transfer of hazardous substance(s) from the site, due to site activities, contamination control procedures are needed.

A site must be controlled to reduce the possibility of: 1) exposure to any contaminants present and 2) their transport by personnel or equipment from the site. The possibility of exposure or translocation of substances can be reduced or eliminated in a number of ways, including:

- Setting up security and physical barriers to exclude unnecessary personnel from the general area.
- Minimizing the number of personnel and equipment onsite consistent with effective operations.
- Establishing work zones within the site.
- Establishing control points to regulate access to work zones.
- Conducting operations in a manner to reduce the exposure of personnel and equipment and to eliminate the potential for airborne dispersions.
- Implementing appropriate decontamination procedures.

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Additionally, efforts must be made to control access onto the site. Decisions regarding the extent of the control efforts will be made by the On-Scene Coordinator, the Safety Officer, and the Project Officer. Most situations will require a surrounding chain-link fence. In addition to limiting access to the public, a fence will reduce animal traffic and the movement of litter, two important vectors of contaminant migration. During periods of onsite activity, site control should be increased in response to the increased hazards. The OSC must maintain a log book of all personnel entering and leaving the site. In some instances this task may become extremely time consuming and the responsibility could be delegated to a security firm.

Some sites may not warrant such extensive security, especially during non-active phases, however control of site access is an important consideration in the development and implementation of the site safety plan.

WORK ZONES

One method of preventing or reducing the migration of contamination and for controlling unauthorized access to contaminated areas is to delineate zones on the site where prescribed operations occur. Movement of personnel and equipment between zones and onto the site itself would be limited by access control points. By these means, contamination would be expected to be contained within certain relatively small areas on the site and its potential for spread minimized. Three contiguous zones are recommended:

- Zone 1: Exclusion Zone
- Zone 2: Contamination Reduction Zone
- Zone 3: Support Zone

Zone 1: Exclusion Zone

The Exclusion Zone, the innermost of three concentric areas, is the zone where contamination does or could occur. All people entering the Exclusion Zone must wear prescribed Levels of Protection. An entry and exit check point must be established at the periphery of the Exclusion Zone to regulate the flow of personnel and equipment into and out of the zone and to verify that the established entry and exit procedures are followed.

The outer boundary of Zone 1, the Hotline, is initially established by visually surveying the immediate environs of the site and determining where the hazardous substances involved are located; where any drainage, leachate, or spilled material is; and whether any discolorations are visible. Guidance in determining the boundaries is also provided by data from the site inspection indicating the presence of organic or inorganic vapors/gases or particulates in air, combustible gases, and radiation, or the results of water and soil sampling.

Additional factors that should be considered include the distances needed to prevent fire or an explosion from affecting personnel outside the zone, the physical area necessary to conduct site operations, and the potential for contaminants to be blown from the area. Once the Hotline has been determined, it should be physically secured, fenced, or well defined by landmarks. During subsequent site operations, the boundary may be modified and adjusted as more information becomes available.

Subareas Within the Exclusion Zone

All personnel within the Exclusion Zone must wear the required Level of Protection. The designation of personnel protective equipment is based on site-specific conditions, including the type of work to be done and the hazards that might be encountered. Frequently within the Exclusion Zone, different Levels of Protection are justified. Subareas are specified and conspicuously marked as to whether Level A, B, or C protection is required. The Level of Protection is determined by the measured concentration of substances in air, potential for contamination, and the known or suspected presence of highly toxic substances.

Different Levels of Protection in the Exclusion Zone might also be designated by job assignment. For example, collecting samples from open containers might require Level B protection, while for walk-through ambient air monitoring, Level C protection might be sufficient. The assignment, when appropriate, of different Levels of Protection within the Exclusion Zone generally results in for a more flexible, effective, and less costly operation, while still maintaining a high degree of safety.

Zone 3: Support Zone

The Support Zone, the outermost part of the site, is considered a noncontaminated or clean area. Support equipment (command post, equipment trailer, etc.) is located in this zone, and traffic is restricted to authorized response personnel. Since normal work clothes are appropriate within this zone, potentially contaminated personnel clothing, equipment, and samples are not permitted, but are left in the Contamination Reduction Zone until they are decontaminated.

The location of the command post and other support facilities in the Support Zone depends on a number of factors, including:

- Accessibility: topography, open space available, locations of highways, railroad tracks, or other limitations.
- Wind direction: preferably the support facilities should be located upwind of the Exclusion Zone. However, shifts in wind direction and other conditions may be such that an ideal location based on wind direction alone does not exist.
- Resources: adequate roads, power lines, water, and shelter.

Zone 2: Contamination Reduction Zone

Between the Exclusion Zone and the Support Zone is the Contamination Reduction Zone, which provides a transition between contaminated and clean zones. Zone 2 serves as a buffer to further reduce the probability of the clean zone becoming contaminated or being affected by other existing hazards. It provides additional assurance that the physical transfer of contaminated substances on people, equipment, or in the air is limited through a combination of decontamination, distance between Exclusion and Support Zones, air dilution, zone restrictions, and work functions.

Initially, the Contamination Reduction Zone is considered to be a non-contaminated area. At the boundary between the Exclusion and Contamination Reduction Zones, decontamination stations are established, one for personnel and one for heavy equipment. Depending on the size of the operation, more than two stations may be necessary. Exit from the Exclusion Zone is through a decontamination station.

As operations proceed, the area around the decontamination station may become contaminated, but to a much lesser degree than the Exclusion Zone. On a relative basis, the amount of contaminants should decrease from the Hotline to the Support Zone due to the distance involved and the decontamination procedures used.

The boundary between the Support Zone and the Contamination Reduction Zone is called the Contamination Control Line, which separates the possibly low contamination area from the clean Support Zone. Access to the Contamination Reduction Zone from the Support Zone is through a control point. Personnel entering there would wear the prescribed personnel protective equipment, if required, for working in the Contamination Reduction Zone. Re-entering the Support Zone requires removal of any protective equipment worn in the Contamination Reduction Zone.

Decontamination consists of physically removing contaminants and/or changing their chemical nature to innocuous substances. How extensive decontamination must be depends on a number of factors, the most important being the type of contaminants involved. The more harmful the contaminant the more extensive and thorough decontamination must be. Less harmful contaminants may require less decontamination. Combining decontamination, the correct method of doffing personnel protective equipment, and the use of site work zones minimizes cross-contamination from protective clothing to wearer, equipment to personnel, and one area to another. Only general guidance can be given on methods and techniques for decontamination. The exact procedure to use must be determined after evaluating a number of factors specific to the site.

Initial Planning

The initial decontamination plan assumes all personnel and equipment leaving the Exclusion Zone (area of potential contamination) are grossly contaminated. A system is then set up to wash and rinse, at least once, all the personnel protective equipment worn. This is done in combination with a sequential doffing of equipment, starting at the first station with the most heavily contaminated item and progressing to the last station with the least contaminated article. Each piece of clothing or operation requires a separate station.

The spread of contaminants during the washing/doffing process is further reduced by separating each decontamination station by a minimum of 3 feet.

Ideally, contamination should decrease as a person moves from one station to another farther along in the line.

While planning site operations, methods should be developed to prevent the contamination of people and equipment. For example, using remote sampling techniques, not opening containers by hand, bagging monitoring instruments, using drum grapplers, watering down dusty areas, and not walking through areas of obvious contamination would reduce the probability of becoming contaminated and require a less elaborate decontamination procedure.

The initial decontamination plan is usually based on a worst-case situation. During the site inspection specific conditions at the site are then evaluated, including:

- Type of contaminant.
- The amount of contamination.
- Levels of protection required.
- Type of protective clothing worn.

The initial decontamination system is then modified, eliminating unnecessary stations or otherwise adapting it to site conditions. For instance, the initial plan might require a complete wash and rinse of chemical protective garments. If disposable garments are worn, the wash/rinse step could be omitted. Wearing disposable boot covers and gloves could eliminate washing and rinsing both gloves and boots and reduce the number of stations needed.

Contamination Reduction Corridor

An area within the Contamination Reduction Zone is designated the Contamination Reduction Corridor (CRC). The CRC controls access into and out of the Exclusion Zone and confines personnel decontamination activities to a limited area. The size of the corridor depends on the number of stations in the decontamination procedure, overall dimensions of work control zones, and amount of space available at the site. A corridor of 75 feet by 15 feet should be adequate for full decontamination. Whenever possible, it should be a straight path.

The CRC boundaries should be conspicuously marked, with entry and exit restricted. The far end is the hotline - the boundary between the Exclusion Zone and the Contamination Reduction Zone. Personnel exiting the Exclusion Zone must go through the CRC. Anyone in the CRC should be wearing the Level of Protection designated for the decontamination crew. Another corridor may be required for the entrance and exit of heavy equipment requiring decontamination. Within the CRC, distinct areas are set aside for decontamination of personnel, restricted to those wearing the appropriate Level of Protection. All activities within the corridor are confined to decontamination.

Personnel protective clothing, respirators, monitoring equipment, sampling supplies, etc. are all maintained outside of the CRC. Personnel don their protective equipment away from the CRC and enter the Exclusion Zone through a separate access control point at the hotline.

SECTION 4

PRELIMINARY DATA GATHERING

INTRODUCTION

Following discovery, a task is initiated to collect and review available information about the known or suspected hazardous substance site or release. The purpose of this task is to determine to the extent possible the magnitude of the hazard, the source and nature of the release or potential release, and the identity of a responsible party, in order to formulate response management decisions.

This is accomplished through telephone and personal contacts with knowledgeable persons, file searches, and analysis of aerial photographs.

The objectives are as follows:

- determine if any contamination problem exists;
- estimate potential severity of the problem and establish priorities for futher investigation;
- focus the inspection and/or field investigation efforts on the proper areas;
- discover potential hazards to field personnel, allowing them to take proper safety precautions;
- incorporate whatever findings are available from previous studies of the site; and
- develop an estimate of the kinds of resources needed to investigate the problem.

This chapter details the kinds of information needed and the sources of information for accomplishing those objectives.

SOURCES OF DATA

Local Contacts

Once a possible problem has been identified, the original source of that information, whether private citizen or government official, should be asked to name all persons who might have knowledge of the site in question. If the original contact is a private citizen, the names of anyone who might be able to corroborate the report should be requested. When appropriate, witnesses should be asked to prepare affidavits in support of their statements. If personal injury or property damage is claimed, ask for the name and telephone number of the attending physician or insurance adjuster. If the source of information is an employee of the facility under discussion, it is advisable to inform that person of employee protection provisions under RCRA, Section 7001.

Government Files

After receiving a report of a possible waste disposal problem, the investigator should examine all appropriate government files. In EPA Regional Offices, Regional Counsels and personnel in the Toxic Substances, Drinking Water, Solid Waste, and Air and Hazardous Waste Materials Divisions should be contacted for information. The investigator should review all information on the site or facility that has been filed in compliance with RCRA or CERCLA. State and local environmental and health agencies may have valuable information regarding the site, disposal practices, and other technical matters. If the operator has ever applied for a NPDES permit, the application has considerable data on wastes disposed at the site and facility design. If no NPDES permit is held by the facility, a demonstration of discharges to surface waters may justify a full enforcement investigation or enforcement action. Information may also be available from state inventories of surface impoundments under the Safe Drinking Water Act or of open dumps under the Resource Conservation and Recovery Act. The U.S. Geological Survey (USGS) should be asked for information on sites under study because it may have investigated ground-water pollution in the area that could lead to the identification of its source. Also universities, research institutes, consultants and contractors may provide useful data. If the facility has applied for a state solid waste permit, information regarding geology, hydrology, and soils may be available. State records of site inspections and enforcement actions should be requested. A state water quality agency may have data on surface water and ground-water quality. In many cases, the county registrar of deeds will provide such information over the telephone; otherwise, they will generally respond to a written request. The investigator should also get highway directions to the site. Zoning or planning commissioners may be able to provide detailed maps of the site and its environs.

The NEIC Information Services Branch provides extensive and comprehensive technical information services to the EPA enforcement program in Headquarters and the Regional Offices. More than 150 computerized data bases on a wide variety of subjects, including chemistry, toxicology, engineering, business, and economics are accessed. Examples of the kinds of information provided are:

1. Corporate information including subsidiaries, profit and loss statements, officers, and previous environmental litigation.

2. Information on specific chemicals, such as toxicity, physical and chemical properties, manufacturers and locations.

3. Ownership of property, operations, employees, etc.

The requestor should provide as much information as possible when requesting assistance. All the information available about the site and potential responsible parties should be included in the written request. In some cases, only the site name and location will be available. The requestor should provide the name, address (if known), city (if known), and state. With a site name and location, NEIC personnel may be able to identify an owner, leasee, operator, etc. If the information is not available, the requestor should check with the county clerk or registrar to determine who owns the property. This information should then be forwarded to NEIC to update the retrieval system.

Records of Generators

RCRA requires that generators complete manifests for each shipment of hazardous wastes transported to a disposal, treatment or storage facility. Copies of these manifests and a biannual summary must be filed with the regional EPA office.

Treatment, storage and disposal facilities must file an application for a permit in accordance with RCRA. These applications must detail the type and quantity of material handled or expected to be handled and additional information regarding the physical facilities. Permits will specify record-keeping, monitoring and maintenance requirements, descriptions of the process, construction and design of disposal and storage facilities, and contingency plans.

Approximately 35 states are now authorized to administer and enforce programs in lieu of the Federal program pursuant with RCRA. In such cases, states may institute operating requirements in addition to those designated by RCRA.

The following list contains the names and telephone numbers of the persons and departments at each EPA regional office who can be contacted for this information:

Region I

Dennis Huebner - (617) 223-6883
Chief, State Waste Programs Branch
U.S. Environmental Protection Agency
John F. Kennedy Building
Boston, MA 02203

Region II

Richard Baker - (212) 264-9881
Permits Administration Branch,
Management Division
U.S. Environmental Protection Agency
26 Federal Plaza
New York, NY 10007

Region III

Shirley Bulkin - (215) 597-4269
Waste Management Branch
Facilities Management Section
U.S. EPA
6th and Walnut Street
Philadelphia, PA 19106

Region IV

Rita Ford - (404) 257-3966
Waste Engineering Section
Residuals Management Branch
U.S. EPA
345 Courtlan Street, N.E.
Atlanta, GA 30308

Region V

Bill Miner - (312) 886-6135
Chief, Technical Permits and Compliance Section
U.S. EPA
230 S. Dearborn St.
Chicago, IL 60604

Region VI

Dave Olschewski - (214) 767-8941
Chief, Technical Section
Hazardous Materials Branch
U.S. EPA
1203 Elm Street
First International Building
Dallas, TX 75270

Region VII

Lynn Harrington - (816) 374-6531
Waste Management Branch
U.S. EPA
324 E. 11th Street
Kansas City, MO 64106

Region VIII

John Minkoff - (303) 837-6238
Waste Management Branch, Air and Hazardous Division
U.S. EPA
1860 Lincoln Street
Denver, CO 80203

Region IX

Bill Wilson - (415) 974-7472
Toxic and Waste Management Division
U.S. EPA
215 Elm Street
San Francisco, CA 94105

Region X

Betty Wiese - (206) 399-1260
Waste Management Branch
U.S. Environmental Protection Agency
1200 6th Avenue
Seattle, WA 98101

The Office of Solid Waste maintains a data base of RCRA information and can make this information available to the EPA regional offices. Much of this data is accessable by computer.

DATA NEEDS

Geology

Knowledge of local bedrock types and depths is important to the investigation of a hazardous waste site, particularly where ground water is a source of drinking water. Sedimentary strata (limestones, sandstones, shales) tend to channel ground-water flows along bedding planes; flow directions may sometimes be determined by the dip of the strata. Solution channels may develop in limestone or marble allowing very rapid transport of pollutants over long distances with little attenuation. Igneous and metamorphic bedrock (granites, diorite, marble, quartzite, slate, gneiss, schist, etc.) may permit rapid transport of polluted ground water along fracture zones. Depth to bedrock may be an important factor in selecting the appropriate type of remedial action. Sources of geologic information include USGS reports and files, state geological survey records, and well drilling logs.

Overburden

Information concerning soil and overburden types and permeabilities is very important in evaluating the potential for migration of contamination from a waste management site. Highly permeable soils (i.e., 10^{-3} cm/sec) may permit rapid migration of pollutants, both vertically and horizontally, away from containment areas. Rates of attenuation, retardation, degradation, and transformation of pollutants in the unsaturated zone and underlying aquifers are a function of soil chemistry, waste chemistry, and physical characteristics of the soil and waste.

Climate

Climate is also an important factor affecting the potential for contaminant migration from a hazardous waste site. Mean values for precipitation, evaporation, evapotranspiration, and estimated infiltration will help determine the potential for transport of pollution at a site, and the possibility of pollutant transfer from the site. Even in an arid region where little or no recharge to ground waters usually occurs, an extremely wet year may have created a serious pollution problem. In evaluating the pollution potential of a "nondischarging" surface impoundment, calculating a water balance will show whether seepage is occurring. The investigator should consult monthly or seasonal precipitation and evaporation (or temperature) records. The maximum recorded or estimated rainfall in a short period of time (24/48-hour or monthly) may be an important factor in evaluating freeboard needed for a surface impoundment. Where airborne contaminants may be a problem, it will be important to determine prevailing wind patterns and velocities. Climate and weather information can be obtained from:

National Climatic Center
Department of Commerce
Federal Building
Ashville, North Carolina 28801
FTS -- 672-0683
(704) 258-2850

Hydrology

The investigator will need information on the ground-water and surface water hydrology at a site and for its environs. Depths to the water table and any underlying aquifers, characteristics of confining layers, piezometric surfaces (heads) of confined aquifers, aquifer head distribution, direction of flow, existence of perched aquifers, and areas of interchange with surface waters will be vital in evaluating the pollution potential of a facility. Ground-water production in the area of the site should be investigated to find depths of wells, pumping rates, and uses of the water. Sources of such information include the USGS, state geological surveys, well drillers, and state and local water resources boards. The list is also available at EPA Regional Offices. Water quality for ground water and surface water, is available from USGS via their automated NAWDEX system; for further information telephone FTS: 928-6081 or (703) 860-6031.

All surface waters and dry water courses in the area should be investigated; surface gradients on and around the site should be determined. If surface waters down-gradient from the site are used for drinking, recreation, fishing, irrigation, or livestock watering, this should be noted. If pollution of surface waters is suspected, collect base-line water quality data and stream flow rates. Obtain information on NPDES permitted discharges in the vicinity of the site under investigation. Useful information on surface waters can also be topographic maps, aerial photography, and the NAWDEX systems.

Sensitive Environments

The investigator also needs to determine if the site is located in a sensitive environment; e.g., inside or adjacent to wetlands, arctic, alpine, desert, estuarine areas, or habitats of endangered species. In general, the potential for long-term environmental disruption, if a discharge or spill of hazardous wastes should occur, must be determined.

Population at Risk

Before visiting a site, it is advisable to gather information about the surrounding area. For the safety of those conducting a site visit, the names and telephone numbers of police and fire departments responsible for that area should be obtained. These departments also may be able to provide information on violations of fire laws and safety codes, including records of incidents at the site. The most important characteristics for determining the hazards in a given situation are population densities and distances to residences, schools, commercial buildings, and any other facilities in the vicinity of the waste site which may be occupied. The investigator should also try to determine if any flammables or explosives, such as liquified natural gas, are stored near the site.

Sources of drinking water in the area, both public and private, should be noted. The investigator should try to obtain copies of analyses performed on these water supplies and determine what treatment system is used by the public. If the site area is serviced by a public water supply, determine locations of water mains to assess the possibility of contaminated ground water entering the public water system. Likewise, information should be gathered on the local sewer and storm drain systems to determine possible infiltration of illegal discharge points. Land use near the site should be studied; types of crops or livestock in the area should be noted, as well as information on the wildlife or aquatic life in the area.

Suspected Contaminants

Information on what material was stored or utilized at the site is invaluable for several reasons. Knowledge of the chemical properties (volatility, solubility, reactivity and flammability, etc.) of the material onsite will assist in the hazard ranking of the site, as will knowledge of the toxilogical effects of these materials. Further, if the characterization proceeds through a Site Inspection or Remedial Investigation, such knowledge will assist investigators in selection of proper levels of protection to reduce the risk of exposure. In addition, it will assist the inspection and investigation in resolving the impact of the site by concentrating efforts on the appropriate vectors for contaminant migration. For example, if it is discovered during the preliminary assessment that the operations at the site dealt extensively with acid solutions and waste metals of low volatility, the remedial investigation can be targeted on the hydrology of the site with less concern for atmospheric dispersion.

Hazardous Waste Management Information

When no information on wastes is available from government sources, it is necessary to proceed with a site inspection and field investigation without background documents. However, it may be possible to hypothesize the kinds of waste discarded at the facility. If a site contains municipal and industrial wastes, it is probable that much of the waste comes from local industries.

Local officials or the Chamber of Commerce may be able to provide information on nearby industries operating during the period in question. At an onsite facility it may be possible to determine the type of waste present from the plant personnel. Information on the composition of waste streams from various industrial processes may be obtained from the Hazardous and Industrial Waste Division of the EPA Office of Solid Waste in Washington, D.C.

Available Aerial Photographs

Aerial reconnaissance is an effective and economical tool for gathering information on waste management sites.

For this application, aerial reconnaissance includes aerial photography and thermal infrared scanning. Aerial photography is universally used for gathering data during daylight hours. The thermal infrared scanning is occasionally done during daylight, but has greater utility at night.

In general, aerial reconnaissance should be performed during a preliminary investigation to obtain data on:

- extent of solid and liquid waste disposal/holding sites within selected facilities;
- casual disposal sites (sites in which control measures are lax or do not exist);
- illegal or promiscuous dumping within industrial, state or municipal facilities or at remote sites;
- unauthorized disposal of liquid waste at solid waste disposal sites;
- visible environmental effects resulting from disposal practices such as spills, surface run-off patterns, surface leachate flow, impoundment leakage and damaged or stressed vegetation in the immediate environs of disposal sites;
- surficial geology such as faults in or near the sites;
- storage container location;
- container inventories;
- waste disposal sites not directly visible or readily accessible from the ground;
- facility design and operation, pertinent to the investigation;
- land use of site environs; and
- location of possible hazards to inspectors.

Information on aerial reconnaissance and the aerial data processing is available at these EPA offices:

Environmental Monitoring Systems Laboratory (EMSL-LV)
P.O. Box 15027
Las Vegas, Nevada 89114
(FTS) 545-2660
(702) 798-2660

National Enforcement Investigations Center (NEIC)
Building 53, Box 25227
Denver, Colorado 80225
(FTS) 234-4650
(303) 234-4650

Environmental Photographic Interpretation Center (EPIC)
P.O. Box 1587
Vint Hill Farm Station
Warrenton, Virginia 22186
(FTS) 557-3110
(703) 347-6224

Each office maintains its own archive of aerial reconnaissance imagery (photography and thermal scanner data) and has access to historical imagery from other government agencies.

Archival Imagery--

Federal agencies have been using aerial photography for a variety of purposes for several decades. Useable photographs less than five years old will usually be available for a site. Frequently however, the scale will be too small to observe details of the site without considerable magnification of the imagery. In cases where it is important to gather information on the locations, areal extent, and historical development of facility operations (e.g., the size and locations of old landfill cells) archival photography can prove invaluable.

Archival photographs are available from:

U.S. Geological Survey
EROS Data Center
Sioux Falls, South Dakota 57102
(FTS) 784-7151
(605) 594-7151

Commercial mapping companies in nearby cities may also have aerial photographs available. There are approximately 200 such firms in the United States.

Photographs taken before 1950 are available from the National Archives.

General Service Administration
National Archives
Cartographic Branch
8th and Pennsylvania Ave., N.W.
Room 2W
Washington, D.C. 20408
(FTS) 756-6700
(202) 756-6700

A list of available aerial photography can be obtained by requesting Special List No. 25 "Aerial Photographs in the National Archives." Generally, the requester must specify the geographical coordinates (latitude and longitude) of the site when requesting aerial photographs. Information on the photography available for a given site usually can be obtained through the above facilities in less than 30 minutes. Standard orders for copies of photographs are processed within six weeks; priority requests require approximately one week at a significantly higher cost. Photo interpretation is available through EMSL-LV in coordination with EPIC and NEIC.

Preparation of Sketch Map--

The sketch map should utilize available aerial photographs of the site and reflect any updated information collected during the Preliminary Assessment. In some instances the aerial photographs will be readily available and of sufficient quality to be used instead of a sketch map. It is often convenient, however, to have multiple copies of an easily reproducible site sketch map which can be marked and drawn on as the investigation progresses.

Determination of Responsible Parties

Cleanup of uncontrolled hazardous waste sites is authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), known as Superfund. Either the Federal government or the responsible parties will clean up the site. If the parties (or party) can be identified, they may be required to either correct the problem or reimburse the Superfund for the government's expense to correct the problem.

Responsible parties may include:

- owners of the site (past and present);
- operators of the site;
- generators of hazardous substances, pollutants, or contaminants that are stored, treated, or disposed of onsite; or
- transporters of hazardous wastes.

The responsible parties are liable* for

- costs** incurred by the Government or a state for investigations, removals or remedial actions;

- any other necessary costs of response incurred by any other person; and

- damages for injury to, destruction of, or loss of natural resources, including the reasonable costs of assessing such injury, destruction, or loss resulting from a release of hazardous substances

Guidelines to aid in the identification of responsible parties are presented in "Procedures for Identifying Responsible Parties, Uncontrolled Hazardous Waste Sites - Superfund", February 1983. At present this document is available, only as a draft, through the NEIC in Denver, Colorado.

During the process of identifying responsible parties-including potentially culpable individuals, interlocking relationships and ownerships, and financial solvency -- it is essential to keep detailed records and notes of what is learned during each step of identification. These records and notes, in addition to providing additional or new leads, will document the EPA effort to identify responsible parties. Documentation is particularly important should a responsible party be identified after the government has spent Superfund monies to correct problems. Also, documentation will be necessary if the party does not agree that it is responsible or partly responsible for the problem at the uncontrolled site.

All further activities including site inspections and field investigations should aid in collecting evidence of responsible parties. In most situations site characterization studies will run parallel with enforcement investigations conducted by OWPE. Cooperation with this office or other evidence audit teams is essential. All requests for responsible party searches should be coordinated with OWPE and will normally be performed by an enforcement contractor.

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*Section 107.(a) of CERCLA (Superfund)

**Costs consistent with the National Contingency Plan, referred to in CERCLA (Superfund)

SECTION 5
SITE INSPECTION

INTRODUCTION

The National Contingency Plan (NCP) mentions Site Inspections as being important parts of both Phase II, Preliminary Assessment and Phase IV, Evaluation and Determination of Appropriate Response - Planned Removal and Remedial Action.

The major objective of a site inspection is to determine if there is any immediate danger to persons living or working near the facility. Additionally, the site inspection should provide the necessary information required for the Hazard Ranking System (HRS).

Scope

The primary items addressed during the site inspection are:

- A determination of the need for immediate removal action;
- An assessment of the amounts, types and location of stored hazardous substances;
- An assessment of the potential for substances to migrate; and
- Documentation of immediate threats to the public or environment.

The NCP states that "In general, the collection of samples should be minimized during inspection activities; however, situations in which there is an apparent risk to the public should be treated as exceptions to that practice."

Time constraints during Site Inspections typically prevent elaborate sample acquisition tasks and may therefore reduce the effectiveness of sample collection in terms of information gain. The limited on-site time often can be more effectively scheduled and utilized by other data gathering and documentation tasks.

A site inspection is usually conducted both offsite and onsite. It often results in the collection of key evidence for immediate enforcement action and identification of responsible parties. Site inspections should be thorough, methodical, and well documented. In order to acheive this goal, the potential Hazardous Waste Site Inspection Report, EPA Form 2070-13, July 1981, should be completed (see Appendix C). In addition to summarizing the information collected during the Site Inspection, this form contains all the information needed to add a site to the automated Emergency and Remedial Response

Information System (ERRIS) should it be required at this point. OERR operates ERRIS as a central computerized tracking system for hazardous waste sites. Chain-of-custody and document control requirements also must be followed. The information collected previously during the preliminary assessment should be thoroughly reviewed, and a strategy for the site inspection effort should be developed and precisely implemented by the investigators.

ONSITE INSPECTION

General

The onsite efforts must closely follow the strategy developed before the inspection began. The site inspection report should be completed to assure that all the tasks are addressed. The objectives may include the following:

- determination of the need for emergency response;
- determination of disposal practices and methods;
- compliance with Federal, State and local regulations;
- determination of the extent of contamination;
- accounting of the amounts and locations of hazardous waste stored;
- determination of the potential for materials to migrate offsite;
- determination of access control;
- documentation or determination of imminent hazards;
- remedies to bring the site into compliance;
- review of site records;
- inventory of drums or drum contents;
- mapping the site;
- determination of safety procedures for field investigation;
- determination of potential sampling sites for field investigation;
- sample collection during inspection;
- collection and preservation of evidence documenting criminal activity; and
- verification of information collected during the Preliminary Assessment.

The site inspection strategy will delineate how the work is to be accomplished. It is essential that all personnel involved agree on the scope of work to meet the objectives. During the site inspection, some modifications in the strategy may be necessary when unforeseen circumstances arise.

Safety

During the site inspection, safety precautions are paramount to all other considerations because the inspector will not have adequate knowledge of site conditions. It is impossible to anticipate every hazard that could arise; therefore, the inspector should use common sense, judgment, and experience. Section 3 of this document provides guidance for establishing proper safety procedures for site inspections.

Photographs

Photographs are important for documenting the cause and effect relationship of hazardous materials migrating offsite as well as for providing visual proof of potential hazards and/or criminal activities. Special attention should be given to areas of apparent environmental damage and potential exposure to the public. Photographs should be taken at every sampling location to verify the written description in the field log book. When using self-contained breathing apparatus, the face mask will make focusing the camera difficult; therefore, it is recommended that a camera with an automatic focus sensor be used. In all cases where photographs are taken, the following information must be recorded:

- time, date, location and, if appropriate, weather conditions;
- complete description or identification of the subject in the photograph and reason why the photograph was taken;
- the sequential number of the photograph and the film roll number; and
- name of person taking picture.

Permission to take photographs should be obtained from the owner or operator of the site. If permission is denied request that the owner/operator or representative take photographs, review them, and send copies. Another approach is to give him/her the roll of film and ask that it be developed and sent to the FIT leader after review by the owner or operator. Care should be taken to avoid photographing a patented process.

If slides are taken, the developed slides should be referenced to the correct description in the field logbook. In many cases, processed slide numbers will not correspond to the number on the camera exposure counter.

When the photographs are developed, transcribe the information recorded in the field logbook onto the back of the photographs. Photographs and negatives are part of the project files and must be accounted for under the Document Control and Chain-of-Custody procedures explained in Section 2 and Volume II, Appendix D.

Mapping the Site

The sketch map prepared during the Preliminary Assessment should be verified, updated and expanded. Information gained during the onsite inspection should be added to the map as soon as possible, preferably before leaving the immediate area of the site. The map will become a primary aid for conducting the Remedial Investigation. In many situations planning for this investigation will be the responsibility of several people each directing a particular task. Thus, the information on the map must be complete and clear to each user and ideally, should not require further interpretation by its author. Symbols and codes should be clearly explained in a legend attached to the map. The map should provide the information needed for siting of command posts, decontamination and safety facilities. The location of utilities and the width and clearance heights of gates and doorways should be marked on the map. If the sketch map is not to scale, appropriate measurements should be made and noted, so that features can be transferred later onto a scale map. Aerial photographs can be very valuable aids to mapping sites.

Preliminary Sampling

Site inspection efforts will not normally involve elaborate sampling; however, safety requirements for onsite inspections (Section 3) usually include the use of instruments capable of detecting hazards which are immediately dangerous to life and health. They most commonly include, but are not limited to the following:

- radiation survey instruments,
- combustible gas/vapor indicators,
- oxygen level indicators, and
- organic gas and vapor detectors.

Each of these general types of devices is fully discussed in Volume II - "Available Sampling Methods". In addition to their use as a personal monitoring device, they can supply valuable information pertinent to planning for the Remedial Investigation. It is virtually impossible for a single individual to accurately survey a site with all four of these instruments and still maintain the level of documentation necessary. In practice, a site inspection usually is carried out by teams of two or more, and because explosimeters and oxygen monitors are often combined into a single device, accurate and well documented surveys are possible. In addition, when sufficient information is available, one or more of these monitors may not be required or can be replaced by more specific instruments where warranted.

Sampling during site inspections usually will be limited to grab samples or screening samples in order to gather information for future sampling and monitoring programs. At this point in the inspection, very little information concerning the site may be known, and detailed sampling efforts could be wasted or results misinterpreted. It may be required, however, to collect preliminary samples during a site inspection. If this is the case, the appropriate sections of Volumes I through III should be consulted. It should be noted that if sampling is required at this point, great care should be exercised to ensure the safety of the public and personnel involved.

All samples collected from onsite should be considered to be potentially high-hazard, and must be handled accordingly unless there is clear evidence to the contrary. Onsite samples include contaminated soils or sludges, liquids from onsite impoundments or pits, leachates, etc. Packaging and shipping requirements for these samples are discussed in Section 2.

Generally, site inspection teams should not collect samples from closed containers. The hazards and risks associated with opening such containers and collecting aliquots demand safety precautions that require personnel and equipment far in excess of a site inspection effort.

Pre-Sample Survey

During the onsite inspection, particular attention should be paid to the areas that may warrant sampling during the Remedial Investigation. These observations will assist the sampling teams in compiling the necessary equipment needed during the conduct of the Remedial Investigation. The type of information that may assist in planning sampling efforts associated with Remedial Investigations is evident from the following questions.

General:

- How rough is the terrain?
- How thick is the underbrush and ground cover?
- What is the apparent typical wind direction?
- How is the waste material arranged?

Surface Waters:

- How large are they? What are their approximate widths and depths?
- Are there currents?
- How steep are the banks and are they secure?
- Is the bottom rock/gravel or sediment/sand?
- Will they flood or freeze?

Soil:

- Is there surface vegetation?
- Does it appear to be landfill or rubble material?

- Are there areas of exposed rock?

This list is by no means complete but exemplifies the type of information that will, in conjunction with inspection reports, photographs, and material from preliminary assessments, assist the Remedial Investigation teams in preparation for their tasks.

Inspection of Onsite Structures

Buildings--

The inspection of buildings and all above-ground structures must be conducted with great care. The inspection should begin with a thorough evaluation of the exterior of these structures. Particular attention should be paid to the type of construction and the (construction) materials used. The inspection should determine if power lines enter the building, and if so, look for a power meter and observe it for current usage. A similar inspection should be made for other utilities. Note all exits and their accessability as well as windows and ventilation. Finally, assess the overall structural stability.

Interior inspections will generally require additional safety precautions and manpower not normally available. The hazards associated with entering a structure require precautions against loss of contact with support personnel, reduced visibility from poor or inadequate lighting, increased trip hazards and obstructions, physical deterioration and structural failure as well as insufficient ventilation and resultant fire, explosion or toxic gas hazards.

In some instances where the building is currently in active use by onsite personnel or the exterior inspection indicates sound construction and adequate ventilation, entry is at the discretion of the On Scene Coordinator. Otherwise interior inspections should be limited to observations from doors and/or windows.

In any case, all windows and doorways should be surveyed (with monitoring equipment) and the readings recorded. If it is then decided to enter the building these instruments should accompany the inspectors.

Basins and Vessels--

Inspections of basins and vessels should verify structural dimensions and note the number and location of input or discharge lines. Any manways, hatches, or valve pits should be identified and monitored with the survey instruments. If the structures contain a material, an estimate of percent full (look for staff gauges or site glasses) and a description of the material should be noted. A general assessment of structural condition also should be included.

Underground Tanks--

The presence of buried vessels is often only apparent upon discovery of small standpipes or vents protruding above the ground surface. All such pipes should be noted and marked with colored tape and/or flags. Closer investigation of the immediate vicinity of the vents often uncovers hatches or valve pits. Further investigation during the inspection should be limited to screening the vents and hatch seals with an OVA, Hnu or other monitors.

Leaving the Facility

Before the onsite inspection is completed, the inspector should update the site map, locating fixed reference points and key features. If samples are collected, the sample locations should be marked on the sketch. An inventory of visible drums should be made where possible and also located on the map.

When the inspection is completed, the inspector should notify the appropriate person at the site. If samples have been collected, RCRA and CERCLA require that before leaving the site the inspector give the owner, operator, or agent-in-charge a receipt describing the sample(s) and, if requested, a portion of each sample equal in volume or weight to the portion retained. If such split samples are provided, a Receipt for Samples form should be completed for the split samples and signed by the owner or agent. If air samples are to be split, duplicate samples must be collected; this must be determined prior to sampling.

If safety clothes or equipment have become contaminated, disposal may be done onsite, provided that the disposal is acceptable to the owner or agent and can be done safely.

If access to the site is controlled by fencing and locked gates, the inspectors must lock the gates when leaving. The date and time the gate was locked should be noted in the field logbook. If left unlocked, an entry should be made in the logbook stating the reason.

OFFSITE INSPECTION

General Environs

Population--

Information regarding population size and distribution should be available from the preliminary assessment. In many instances this information, if obtained from state or regional agencies will be somewhat dated. It is important therefore to tour the area assessing the likelihood of significant demographic changes. Recently constructed housing developments, apartments, schools and public buildings may indicate that changes have occurred since the information was published.

Land Use--

The same circumstances necessitating reevaluation of population information hold true for land use studies. Substantial alterations in the immediate area of the site can occur in a single year. Farmland can be developed into industrial parks, office or apartment complexes or other high population density uses. Careful observations for signs of recent excavation such as roadway construction or resurfacing, stream or bank improvements, trenching for sewer or other utility installation are all critical. These situations can dramatically effect the sites hydrology, public access, animal population, as well as many other aspects of a site which will have impact on future remedial or enforcement activities.

SECTION 6

DATA EVALUATION

INTRODUCTION

Following and in many cases concurrent with the collection of preliminary information, a data assessment is performed to ultimately assist in formulating response management decisions affecting later stages of the investigation. The data evaluation may also indicate data gaps which need to be filled either by further background research or additional site inspections (or an initial inspection if one has not yet been conducted). Following the completion of the organization and review of all collected information, the site is then given a ranking through the mechanism of EPA's Hazard Ranking System (HRS), and, depending upon the magnitude of the resulting score, the site may or may not be placed on the National Priorities List (NPL). All of this information is ultimately used to choose a course of action concerning future remedial activities.

Scope

The evaluation should encompass the scope detailed below:

- the existance (or nonexistance) of a potential hazardous waste problem;
- probable seriousness of the problem and the priority for further investigation or action; and
- the type of action or investigation appropriate to the situation.

Participants

Evaluation of the data by a team of specialists is desirable. Participants with some or all of the following professional and technical skills should be included in the process as appropriate: an environmental engineer (environmental, civil, sanitary, chemical or industrial engineer), a geohydrologist, a chemist, and an attorney are recommended. Personnel with skills in the assessment of health effects of exposure to toxic or hazardous substances, engineering personnel with the ability to assess appropriate remedies of hazardous waste disposal sites, and biologists trained and experienced in bioassay techniques (static and flow-through) may be needed.

Necessary Data

The data needed to evaluate the pollution potential of a hazardous waste site can be roughly organized into the four categories presented in Table 6-1. Each category can be defined generally as follows:

"Waste Characteristics" refers to factors describing the nature of the substances, i.e., their immobility and persistence in the environment. "Waste Management" answers whether the materials are adequately isolated and contained or destroyed at the site. "Pathways" describes possible routes of material movement offsite and must be considered as a function of time. "Receptors" describes the sensitivity of the site environs to pollution. Data sets under each heading provide a relatively limited amount of information; available manufacturing process information should be factored into any decision. In many instances, not all needed information will be available for initial evaluations; therefore, site inspection and field investigation efforts should be focused on acquiring this missing information.

All of the collected data needs to be summarized in a fashion that ensures completeness, uniformity and ready access. To accomplish this, it is sometimes helpful to use a form or checklist as an organizational aid. The "Potential Hazardous Waste Site Preliminary Assessment Form, EPA 2070-12, July 1981" (see Appendix B) is an example of such a form which is useful for this purpose. It is normally used to place site information in a format compatible with the automated Emergency and Remedial Response Information System (ERRIS).

ERRIS is one of the two automated data systems developed by OERR to inventory and later track National Priority List (NPL) sites. It is an automated inventory of all uncontrolled hazardous substance sites in the United States which are known to the EPA. As such, it contains a multitude of information concerning the site including location, description, summary of response actions, enforcement status, site characteristics and regional input, etc. If a site is placed on the NPL, information is transferred to the second data system entitled Project Tracking System (PTS). The PTS is further updated on a regular basis through regional input and is used to track planned and actual activities for each NPL site.

Evaluation of Pollution Potential and Setting Priorities

In evaluating the information on a specific waste disposal site, the problem must be broken down into the various types of pollution or health problems, i.e., ground water, surface water, air direct contact, and fire/explosion. Under each item on Table 6-1 there is a key to relate that item to a problem. The pollution potential for each problem type should be evaluated separately on the basis of the relevant factors.

In passing CERCLA, Congress recognized the need for a systematic approach to setting priorities. Section 105(8) of the Act requires the President to include criteria for setting priorities among releases and potential releases of hazardous substances as part of the National Contingency Plan. The criteria take into account the population at risk, the nature of the hazardous substances, the potential for contaminating drinking water supplies, the potential

TABLE 6-1. DATA REQUIRED FOR EVALUATION

Waste Characteristics	Waste Management
Toxicity (Sax toxicity)[l,g,s,a,d]	Leachate/runoff collection and treatment system[l,s,g]
Ignitability (flash point or NFPA number)[f,l,a,g]	Linears[g]
Reactivity[l,a,d,g,f]	Site security[d,f]
Corrosivity[l,d]	Incompatible wastes[a,d,f]
Infectivity[l,g,s,a,d]	Condition of containers[l,g,s,a,d,f]
Persistence[l,g,s,a]	Danger of fire or explosion due to poor management practices[a,d,f]
Radioactivity[l,g,s,a,d]	
Quantity[l,g,s,a,f]	Incinerator performance/pollution control devices[a]
Solubility[l,a,d,f]	
Volatility[l,a,d,f]	
Viscosity[l,s,g,f]	

Pathways	Receptors
Depth to ground water[g]	Population density[l,g,s,a,d]
Soil permeability[g]	Proximity to surface drinking water supply[s,g]
Bedrock permeability[g]	Proximity of drinking water wells[g]

(continued)

Key:

[l] Land
[g] ground water
[s] surface water
[a] air
[d] direct contact
[f] fire/explosion

TABLE 6-1. (Continued)

Pathways	Receptors
Proximity to surface water body[s,g]	Proximity to nearest nonsite-related building[l,a,d,f]
Net precipitation[g,s]	Zoning/land-use of adjacent area[l,a,d,f]
Soil thickness[g]	Zoning/land-use of adjacent area[l,a,d,f]
Evidence of ground-water contamination[g]	Endangered species or critical environments potentially affected[l,g,s,a,d]
Evidence of air contamination[a]	
Evidence of land contamination[l]	

Key:

[l] Land
[g] ground water
[s] surface water
[a] air
[d] direct contact
[f] fire/explosion

for direct human contact, the potential for destruction of sensitive ecosystems, state preparedness and other appropriate factors.

In setting priorities, the investigator should be familiar with the following model developed specifically for evaluating these data. The general characteristics of this model are summarized below:

Hazard Ranking System--

EPA in conjunction with the MITRE Corporation developed a method for ranking facilities according to risks to health and the environment. It is designed to address surface water, air, fire and explosion, direct contact, and ground-water contamination. Three migration routes of exposure (see Table 6-2); ground water, surface water, and air are evaluated and the scores are combined to derive a score representing the relative risk posed by the facility. Two additional routes of exposure, (1) fire and explosion, and (2) direct contact, are measures of the need for emergency action. The routes are scored independently and the dependent nature of the variables

TABLE 6-2. COMPREHENSIVE LIST TO RATING FACTORS

Hazard code	Factor category	Factors		
		Ground Water	Surface	Air route
Migration	Route Characterization	o Depth to Aquifier of Concern o Net Precipitation o Permeability of Unsaturated Zone o Physical State	o Facility Slope and Intervening Terrain o One-Year 24-Hour Rainfall o Distance to Nearest Surface Water o Physical	
	Containment	o Containment	o Containment	
	Waste Characteristics	o Toxicity/Persistence o Hazardous Waste Quantity	o Toxicity/Persistence o Hazardous Waste Quantity	o Reactivity/ Incompatibility o Toxicity o Hazardous Waste Quantity
	Targets	o Ground-Water Use o Distance to Nearest Well/ Population Served	o Surface Water Use o Distance to Sensitive Environment o Population Served/ Distance to Water Intake Downstream	o Land Use o Population within 4-Mile Radius o Distance to Sensitive Environment
Fire and Explosion	Containment	o Containment		
	Waste Characteristics	o Direct Evidence o Ignitability o Reactivity o Incompatibility o Hazardous Waste Quantity		

(continued)

TABLE 6-2. (Continued)

Hazard	Factor category	Factors Ground Water	Surface	Air route
	Targets	● Distance to Nearest Population ● Distance to Nearest Building ● Distance to Nearest Sensitive Environment ● Land Use ● Population Within 2-Mile Radius ● Number of Buildings Within 2-Mile Radius		
Direct Contact	Observed Incident	● Observed Incident		
	Accessibility	● Accessibility of Hazardous Substances		
	Containment	● Containment		
	Toxicity	● Toxicity		
	Targets	● Population Within 1-Mile Radius ● Distance to Critical Habitat		

is reflected by multiplying where appropriate. The system requires a great amount of detailed information. If real data are not available, estimates must be made. However, the final scores from estimates are adjusted lower than scores obtained using known data, to represent the uncertainty inherent in estimates.

The Hazard Ranking System (HRS) has been incorporated into the Federal Register (Vol. 47, No. 137, Friday July 16, 1982/Rules and Regs. pg. 31219, Subpart H, "Section 300.1) and is the only model currently used by EPA to assess risk during hazardous waste site investigations. The HRS evaluates the input parameters and yields a final "score". The magnitude of this score will determine if the site will make the National Priority List and its eligibility for assistance under Superfund.

OPTIONS FOR ACTION

Upon completion of the preliminary data gathering phases, certain decisions must be made concerning further actions needed at the site. Subpart F, 300.66 (a) of the NCP, makes provisions for the determination of appropriate action when (1) the preliminary assessment indicates that further response may be necessary, or (2) the On Scene Coordinator (OSC) requests and the lead agency concurs that further response should follow an immediate removal action.

The NCP specifies the following alternatives when further action is necessary:

- Planned Removal
- Remedial Actions
  - Initial Remedial Measures
  - Source Control Remedial Measures
  - Offsite Remedial Measures

No Action Required

When the evaluation indicates that the site has been operated and closed properly, and further inspection is deemed not necessary, a report should be prepared summarizing the data and conclusions. The report should include all information collected including the rationale used to arrive at the decision for no action. If any inspection or field investigation was conducted as part of the data gathering activities, all data and resulting conclusions should be incorporated.

Planned Removal

As specified in Section 300.67 of the NCP, planned removals may be undertaken when the lead agency determines that (1) there would be a substantial cost reduction by continuing a response action undertaken as a result of an immediate removal, or (2) when the public and/or the environment will be at risk from exposure to hazardous substances if the response to a release from sites not on the NPL is delayed. EPA has further specified a number of criteria in 300.67 for determining if a planned removal is appropriate.

These factors include:

1. Actual or potential direct contact with hazardous substances by nearby populations.
2. Contaminated drinking water at the tap.
3. Containerized wastes that are known to pose a public health or environmental threat.
4. Highly contaminated soil (largely at or near the surface) that pose a public health threat or an environmental threat.
5. Serious threat of fire or explosion.
6. Weather conditions that may cause substances to migrate or pose a threat to public health or the environment.

Each of these factors should be carefully considered prior to deciding on a planned removal action. In addition, a planned removal cannot be initiated, unless the Governor (or his designee) of the state affected requests the action. Section 300.67(b) lists those factors which must be included in this request.

A planned removal action is terminated once the risk to public health or the environment has been abated. Planned removals are therefore meant to relieve an imminent threat to public health or the environment prior to the implementation of a permanent remedy. In this regard, planned removals are not to be confused with remedial actions which are responses (to NPL sites) that are consistent with permanent remedy.

Remedial Action

Remedial actions taken at a hazardous waste site are those responses to release of hazardous substances from NPL sites that are consistent with the institution of a permanent remedy. The two general responses, initial remedial measures and final remedial actions, include both source control and offsite remedial actions. Initial remedial measures are taken to limit exposure or threat of exposure to a significant health or environmental hazard and are undertaken prior to final selection of appropriate remedial action. Conversely, source control remedial actions and/or offsite remedial actions are conducted after all data have been evaluated to select the most appropriate and feasible alternative.

Initial Remedial Measures--

As previously discussed, initial remedial measures (IRM's) are taken before final selection of the appropriate remedial action. They are intended to limit exposure or threat of exposure to a significant health or environmental hazard, provided such measures are cost-effective (300.68)(e)(1).

The NCP further lists a number of criteria that should be reviewed before initiation of an IRM. These factors include:

1. Actual or potential direct contact with hazardous substances by nearby populations.

2. Absence of an effective drainage control system (with an emphasis of run-on control).

3. Contaminated drinking water at the tap.

4. Hazardous substances in drums, barrels, tanks, or other bulk storage containers above surface posing a serious threat to public health or the environment.

5. Highly contaminated soils largely at or near surface, posing a serious threat to public health or the environment.

6. Serious threat of fire or explosion or other serious threat to public health or the environment.

7. Weather conditions that may cause substances to migrate and to pose a serious threat to public health or the environment.

These factors need to be thoroughly reviewed prior to the determination of the need for an IRM. In addition, an IRM cannot be implemented without compliance with 300.67(b) of the NCP. As with Planned Removals, this section requires the Governor of the affected state, or his designee, to request the action.

Final Remedial Action--

In order to select the most effective, economically feasible, and technically sound alternative for permanent remedy, it will be necessary to evaluate all available information about the site. To accomplish this, a series of defined steps are taken which ultimately results in the selection of the most cost effective alternative. It is far beyond the scope of this document to provide guidance for performing these various steps. Detailed guidance available from the appropriate EPA program offices will accomplish this task much more effectively. The following synopsis of the various steps called for in the NCP is therefore presented for convenience and does not reflect the differences in approach taken by enforcement, or remedial action, driven investigations. The basic steps involved include:

- Scoping Phase
- Remedial Investigation
- Feasibility Study
- Design and Implementation

In general, permanent remedies include the following two categories:

- Source control remedial actions, and
- Offsite remedial actions.

A description of these actions, including the appropriate NCP citation, follows.

Source Control Remedial Actions--As specified in 300.68(e)(2) of the NCP, source control remedial actions may be deemed appropriate if a substantial concentration of hazardous substances remain at or near the site or near the area where they were originally located and inadequate barriers exist to retard migration of substances into the environment. Source control may involve containing the substances where they are located or transporting the substances offsite. In order to determine whether and what type of action is appropriate, the NCP further states that the following criteria be considered:

- "The extent to which substances pose a danger to public health, welfare, or the environment. Factors which should be considered in assessing this danger include: population at risk; amount and form of the substance present; hazardous properties of the substances; hydrogeological factors; and climate."
- "The extent to which substances have migrated or are contained by either natural or man-made barriers."
- "The experiences and approaches used in similar situations by state and federal agencies and private parties."
- "Environmental effects and welfare concerns."

Source control remedial actions that might be considered include but are not limited to:

- No action
- Containment
- Pumping
- Collection
- Diversion
- Complete removal
- Partial removal
- Onsite treatment
- Offsite treatment

- In situ treatment

- Storage

- Offsite disposal

Offsite Remedial Actions--In 300.68(e)(3), the NCP states it may be appropriate in certain situations to take actions necessary to minimize and mitigate the migration of hazardous substances and the effects of such migration. These actions should be taken when it is determined that source control remedial actions may not effectively mitigate the problem.

The NCP further specifies that the following criteria be considered to determine the nature and type of offsite actions to be considered:

- "Contribution of the contamination to an air, land, or water pollution problem."

- "The extent to which the substances have migrated or are expected to migrate from the area of their original location and whether continued migration may pose a danger to public health, welfare, or environment."

- "The extent to which natural or manmade barriers currently contain the hazardous substances and the adequacy of the barriers."

- "The factors listed in paragraph (e)(2)(i) of this section."

- "The experiences and approaches used in similar situations by state and federal agencies and private parties."

- "Environmental effects and welfare concerns."

Offsite measures which may be deemed appropriate after consideration of the specified criteria include:

- Permanent alternative water supplies;

- Management of a drinking water aquifer plume;

- Treatment of drinking water; and

- Relocation of receptors.

SECTION 7

FIELD INVESTIGATIONS

INTRODUCTION

The National Oil and Hazardous Substance Pollution Contingency Plan (NCP) directly provides for sample acquisition and analysis during three of the seven phases detailed in Subpart F, Hazardous Substance Response, those being:

- Phase III Immediate Removal
- Phase IV Evaluation and Determination of Appropriate Response-Planned Removal and Remedial Action
- Phase VI Remedial Action

Field Investigations, with respect to this document, involve actual sample acquisition and associated support activities in the field. Field Investigations differ from Site Inspections (Section 5) both with respect to the extent that they employ sample collection and the goals that they must meet. Whereas the primary goal of a Site Inspection is to identify and document the presence of hazards, the goal of a Field Investigation is to characterize the site for anticipated remedial or enforcement activity.

A Field Investigation may be conducted in association with a number of various tasks which must be performed by regulatory and enforcement agencies, both Federal and State. Examples of tasks which may require Field Investigations are as follows:

- Remedial Investigation/Feasibility Studies as conducted by EPA, OERR
- Enforcement Remedial Investigations as conducted by EPA, OWPE
- Immediate Removal Actions as conducted by OERR or State Environmental Agencies

In order to effectively utilize funds and limit exposure of field personnel to onsite hazards, Field Investigations, regardless of their goals or office of direction, must be designed to yield maximum information with minimum time on site. Often a Field Investigation will involve several agencies and contractors simultaneously. Effective use of these resources in a potentially hazardous environment requires thorough planning and careful coordination.

The remainder of this section provides guidance in the effective preparation of the Sampling Plan and its efficient implementation.

PREPARATION OF THE SAMPLING PLAN

If after completing the Site Inspection (Section 5) and after reviewing the background information of the Preliminary Assessment (Sections 4 and 6), it is decided that a Remedial Investigation is needed, a comprehensive Sampling Plan should be prepared. The Sampling Plan will generally be prepared by the Project Manager. The Sampling Plan thoroughly details the course of the project in terms of scope, logistics, and schedules. Among the items addressed in the Sampling Plan are:

- objectives of the project;
- summary of background information;
- survey methods, including sampling locations, procedures, analytical requirements, quality control program, etc.;
- personnel and equipment requirements including subcontracts; and
- Chain-of-custody procedures.

A Safety Plan (see Section 3) and a QA Plan are prepared separately, but are typically attached to the Sampling Plan as appendices.

The importance of the Sampling Plan cannot be overemphasized. The Plan delineates manpower, equipment needs, schedules and logistics. The need for additional equipment, contract services, or personnel must be determined far enough in advance so that they can be secured expeditiously.

As appropriate, the Sampling Plan should be provided to the field team, analytical staff, Quality Assurance Officer, Project Officer for any parallel enforcement investigation, and other Regional personnel involved in the Project at least four weeks before any specific field, laboratory, or consultant activity is undertaken. During the conduct of the project, some modifications to the Plan may be necessary because of changing conditions. Before implementation, the Sampling Plan and any subsequent changes to it must be approved by the Project Officer.

The remainder of this subsection deals with those aspects which must be considered during the preparation of a Sampling Plan.

Sampling Considerations

Purpose and Objectives of Sampling--
The samples should provide the data to meet the objectives specified in the Sampling Plan. The locations, types, and numbers of samples to be collected should be determined from the site inspections and specified in detail in the Plan. The objective of sampling is to acquire data which will assist agency personnel in determining:

- the identification of the hazardous waste or substances present at the site, and

- the occurrence and extent of hazardous substance migration.

The analysis of samples often provides a crucial portion of the evidence used in subsequent litigation and is used in the development of appropriate remedial action alternatives. In addition, this information will assist enforcement personnel to prepare an Endangerment Assessment.

Hazardous waste sites are sampled to characterize the site for enforcement or remedial work. The investigator must remain aware that any data collected might be used in litigation and should always follow enforcement procedures (chain-of-custody, etc.).

Computer Modeling--

Computer-based predictive models for the assessment of potential air emissions and ground-water contaminant migration are powerful and effective aids in the determination of environmental impact. Consideration should be given to the eventual use of such models during development of the Sampling Plan. An understanding of the input data requirements of the models and their capabilities may influence the selection of sample locations, collection techniques, and analysis and may actually enhance the general information yield.

Sample Categories--

Samples collected during site investigations generally can be classified as environmental samples or hazardous samples. Hazardous samples are further classified as "other than from closed containers" and "from closed containers". Environmental samples contain concentrations of contaminants which have been diluted due to runoff, mixing with surface and/or ground waters, weathering, etc. Judgment by the Project Leader is essential in cases where runoff may contain high concentrations of hazardous materials. If there is reason to expect higher concentrations in runoff or other surface samples, they should be declared "hazardous". Samples collected from spills, drums, tanks, or other vessels are defined as hazardous samples because of the anticipated high concentrations of contaminants.

Sample Source Identification--

The location of the source of each sample should be clearly defined in the Sampling Plan. Whenever possible, sampling locations should be documented by photographs. Every potential or priority sample location must be indicated on the site sketch and described in detail in the Sampling Plan, specifying any special safety requirements. For example:

Station 01: Environmental sample from onsite surface water impoundment. Sample to be collected from top 6 in. of water. Sample location 140 ft north and 30 ft east of power pole No. 87389.

Station 02: Hazardous sample from opened drum marked "sodium nickel cyanide". Drum located inside the onsite warehouse building, against the wall, 3 ft west of the north entrance marked "E-2". Collect the sample over the entire depth with thief and place entire sample into container. SCBA and full protective clothing must be worn.

A precise description of the sample location is important to insure that field teams sample at the area of interest. Detailed and complete descriptions of the exact location sampled will be essential if the case proceeds to litigation.

Statistical Considerations

General--

The underlying goal of any sampling campaign is to collect samples which are representative of the media under consideration in relation to objectives of the sampling program. In the "real world", however, especially when dealing with hazardous waste site samples, collection of a truly representative sample can be quite difficult if not impossible. Nonetheless, this fact should not deter the investigator from making every attempt to realize this ultimate goal.

To assist in this endeavor, a sampling strategy should be developed which details site location, number of samples to be collected, and the duration and frequency of sampling. The selected strategy would be dependent upon a number of factors, one of the most important being the variability of the parameters of interest (concentration) in space and time. This factor gives rise to the need to address some basic statistical considerations to aid in the decision making process surrounding sample strategy selection.

It should be noted at this point that the discussion that follows is an overview of the theoretical approach for collecting a representative sample based on general statistical considerations. For a detailed explanation of sampling statistics, refer to any of the following reference sources used to develop this section:

- Harvey, R. P. Statistical Aspects of Air Sampling Strategies. In: Detection and Measurement of Hazardous Gases; Edited by C. F. Cullis and J. G. Firth. Heinemann Educational Books, London, 1981.

- Mason, B. J. Protocol for Soil Sampling: Techniques and Strategies. U.S. EPA Environmental Systems Laboratory, Contract No. CR808529-01-2. March 30, 1982. EPA-600/54-83-0020.

- Smith, R. and G. V. James. The Sampling of Bulk Materials. The Royal Society of Chemistry, London. 1981.

- U.S. Environmental Protection Agency. Handbook for Sampling and Sample Preservation of Water and Wastewater. EPA 600/4-82-029. September 1982.

Media Variability--Contaminant concentrations can vary considerably from location to location within a specified study area or they can vary with time, i.e., during the course of a normal workday/shift or a time period encompassing several months or seasons. These variations are due to a number of factors or combination of factors such as:

- variations in the number of contaminant sources;
- variations in contaminant release rate;
- variations in contaminant dispersion from its release source; and
- length of time since release occurred.

When personal monitoring techniques are used, differences in individual worker habits also may add to variations in collected samples. Factors include the individuals proximity to contaminant sources, differences in the nature of jobs/tasks between workers, and unique work habits.

The possibility of contaminant variability is especially true for hazardous waste site investigations. Areas of contamination may occur in localized "pockets" scattered throughout the site. Types and concentrations of contaminants will vary considerably from container to container or from area to area.

Sampling Strategies--The selection of a sampling strategy is influenced by a number of factors, two of the most important being project objectives and statistical considerations. In relation to the former, the main objective of a hazardous waste site investigation is to identify the compounds present and to assess the extent to which these compounds have become integrated into the surrounding environment. Sample analyses data may be needed for future litigation and/or to provide a basis for remedial action. A sample must be as representative as possible of the media in question and data obtained from the analysis of the sample must be defensible. The best way to assure that these requirements are met is to include a statistically based sampling approach as part of the sampling strategy. The scope of a sampling effort must further fall within the limitations of such resources as time, personnel, and available funds, and these factors must be considered when establishing the overall strategy. For the purpose of this document, five sampling strategies are detailed below:

1. Random Sampling--Random sampling uses the theory of random chance probabilities to choose representative sample locations. Random sampling is generally employed when little information exists concerning the material, location, etc. It is most effective when the population of available sampling locations is large enough to lend statistical validity to the random selection process. Since one of the main difficulties with random sampling deals with achieving a truly random sample, it is advisable to use a table of random numbers to eliminate or reduce bias.

2. Systematic Random Sampling--Systematic sampling involves the collection of samples at predetermined, regular intervals (sampling within a grid square). It is the most often employed sampling scheme; however, care must be exercised to avoid bias. If, for example, there are periodic variations in the material to be sampled such that the systematic plan becomes partially phased with these variations then errors can be introduced by implementation of the systematic approach.

A systematic sampling plan is often the end result of an approach that was begun as random due to the tendency of investigators to subdivide a large sample area into increments prior to randomizing.

3. Stratified Sampling--Data and background information made available from the preliminary site survey, from prior investigations conducted onsite, and/or from experience with similar situations can be useful in reducing the number of samples needed to attain a specified precision. Stratified sampling essentially involves the division of the sample population into groups based on knowledge of sample characteristics at these divisions. The purpose of the approach is to increase the precision of the estimates made by sampling. This objective should be met if the divisions are selected in such a manner that the units within each division are more homogeneous than the total population. The procedure basically involves handling each division separately with a simple random sampling scheme.

4. Judgment Sampling--A certain amount of judgment often enters into any sampling approach used; however, this practice should be avoided when a true random sample is desirable. Judgment approaches tend to allow investigator bias to influence decisions, and, if care is not exercised, can lead to poor quality data and improper conclusions. If judgment sampling does become necessary, it is advisable that multiple samples be collected in order to add some measures of precision.

5. Hybrid Sampling Schemes--In reality, most sampling schemes consist of a combination or hybrid of the types previously described. For example, when selecting an appropriate plan for sampling runs at a hazardous waste site, the initial staging of drums might be based on preliminary information concerning contents, program objectives, etc. (judgment, stratified sampling), and then sampled randomly within the specified population groups (random sampling). Hybrid schemes are usually the method of choice as they can allow sampling from a diverse population; but, by reducing the variance, can improve precision within each subgroup.

Number of Samples--More often than not, the number of samples collected will be dictated by the financial limitations of a specific sampling campaign. This is especially true for sampling hazardous wastes because, generally, most of the available funds are earmarked for the remedial phase of an effort. Practicality and common sense must be exercised because onsite manpower costs, packaging and transportation costs, and analytical fees can easily become excessive. An excellent basis for sample plan management is the statistical determination of the number of samples needed. It is generally necessary to have some preliminary data available to increase the confidence in obtained results; however, estimation of the needed values is an alternative. With these data, the number of samples required to obtain a given precision with a specific confidence level can be obtained from the following equation:

$$n = t_\alpha^2 S^2/D^2 \qquad (1)$$

where n = number of samples

D = precision given in the specifications of the study

S^2 = sample variance

t_α = two tailed t-value at an α level of significance and (n-1) degrees of freedom

D is generally expressed in specified concentration units (i.e., ±10 $\mu g/m^3$) and t_α is obtained from standard statistical tables. The sample variance will have to be determined from preliminary or previous data or estimated from the literature.

The above equation (1) can also be expressed in terms of the coefficient of variation:

$$n = t_\alpha^2 (CV)^2/p^2 \tag{2}$$

where n = number of samples

CV = coefficient of variation ($S/\bar{x}$ - expressed as a percent or fraction)

$\bar{x}$ = sample mean

p = allowed margin of error ($D/\bar{x}$ - expressed as a percent or fraction)

t_α = the two tailed t-value at an α level of significance and (n-1) degrees of freedom

Since the t-value is dependent upon the number of degrees of freedom, it is necessary to use an iterative approach to arrive at the number of samples to use. Curves can be prepared that plot the number of samples against the coefficient of variation and thereby eliminate the need for these iterations. The use of this equation assumes that the population under study is normally distributed and that less than 10 percent of all possible samples in the study area are being collected.

Use of Equations (1) and (2) is not recommended without additional background and information on statistical experimentation and design. They are listed here for illustration purposes only. For a detailed explanation of these approaches, refer to the reference material cited at the beginning of this section.

Duration and Frequency of Sampling--The duration of a sampling program and the frequency with which the samples are to be collected are dictated by a number of factors: number of samples specified, predetermined length of an investigation, anticipated variations over time (seasonal, meteorological, etc.) objectives of the effort, safety considerations and available funds. The statistical concepts discussed previously will assist investigators in determining how often to sample and over what period of time. These concepts should be maintained whenever possible; however, predetermined logistical and judgmental criteria may influence these approaches. It is often beyond the control of the investigator to alter these factors; however, it is important to reduce or eliminate bias when outlining an approach.

What to Sample

Unnecessary sampling should be avoided to reduce exposure of field personnel to hazardous materials. Sampling should be performed in a safe manner using the methods presented in Volume II of this manual. If possible, samples from each media which might be contaminated by hazardous materials--air, soils, sediments, and water--should be taken to help establish risks.

Soil and Sediment--

The soils and sediments at a hazardous waste site can provide information about the existence and extent of contaminant migration. Vertical migration of contaminants may occur through soil strata into the ground water, with subsequent lateral transport of pollutants.

Many of the soil and sediment samples collected are grab samples. Soil samples should be collected from areas where dumping, spills, or leaks are apparent. Sediment samples should be collected from areas upstream and downstream of the suspected contaminant entry and in areas where sediment deposition is significant. Quiescent areas are likely locations for sediment deposition. Because the soils or sediments may be saturated with contaminants, the samples should be considered hazardous.

Samples usually can be collected readily from the first 18 inches (depending on soil or sediment type) by relatively simple, manual techniques as described in Volume II. Samples from greater depths usually require more elaborate equipment and are both more expensive and time consuming.

The samples can be analyzed directly for many of the priority pollutants by various extractions or the soil can be leached and the leachate analyzed as per the EP toxicity method.

Surface Water and Impoundments--

Surface waters on or adjacent to a suspected hazardous waste site can yield significant information with minimal sampling efforts. Surface waters can reveal the presence of contamination from any of several mechanisms, either direct discharge, runoff, ground-water inflow, or atmospheric particulate deposition.

If only a knowledge of the presence or absence of contamination in the water is needed, the collection of grab samples will usually suffice. If the water body is a stream, samples also should be collected from upstream and downstream of the area of concern.

Additional monitoring of surface water is required of seeps, spills, surface leachates, etc., both on and offsite. If the site has NPDES outfalls, the discharges should be sampled.

More elaborate programs utilizing stream flow information and weather conditions can further isolate inputs and the effects of both surface runoff and ground-water inflow, although this usually requires extended time frames.

The objective for monitoring surface impoundments is to assess the potential for ground-water contamination and to determine possible hazards if the water should leave the site due to overflow or dike failure. Another objective is to determine if there are volatile organic compounds which could be released to the atmosphere.

Water samples can be analyzed for all of the current EPA listed "Priority Pollutants" by published methods. Other standard analytical protocols can be utilized to supply additional information which may be indicative of contamination migration. Alkalinity, acidity, TOC, TOX, and COD are often excellent indicators of contamination and can be used as screening techniques before implementing the more costly Priority Pollutant analysis.

In situ measurements of pH, conductivity, temperature and dissolved oxygen can serve to isolate areas of inflow or to assess relative variations around the site. The immediate results and ease of operation of the appropriate instruments make them valuable tools.

Ground Water--

Geohydrologic investigations at hazardous waste sites are a critical aspect of any evaluation. The impact of a site on the ground water is a significant factor in the ranking generated by the Hazard Ranking System.

Ground-water contamination is usually difficult and costly to assess, control, and clean. Since ground-water contamination may not be evident from the surface, a contaminated aquifer may insidiously spread the area of impact of a site well beyond its surficial boundary. If the aquifer supplies drinking water to a population, the direct uptake of aquifer borne contaminants by ingestion can have severe health effects.

The subsurface is a unique heterogeneous environment. Gas exchange, biological and other chemical reactions and conditions are quite different from those on the surface. The ground water is usually well insulated from surface temperature variations and thus its temperature is maintained at a rather constant level.

Exposure of ground water to surface conditions can cause significant and rapid reactions as a result of increased light and oxygen, and changes in temperature and pressure. This is true both of ground-water seeps and springs as well as the discharge of wells. Gas exchange, microbial growth, and the rate of many chemical reactions approximately double for every 10°C increase in temperature, and the effect of sunlight and the presence of oxygen can cause equally dramatic and nearly instantaneous reactions.

Monitor wells sample a small part of an aquifer horizontally and vertically depending on screen size, placement depth, pump rates and other factors which affect the cone of influence at a well. The use of existing wells and piezometers can introduce an additional problem due to materials contamination and inadequate construction. Proper well construction requires significant skill and expense and should not be attempted without consultations with an experienced geohydrologist. Interpretation of the results of analysis of ground-water samples relies on the collection of representative water samples and an accurate knowledge of the aquifer characteristics. General guidelines for ground-water sampling can be found in the "Manual of Ground Water Sampling Procedures" Scalf, McNabb et al., EPA-600/2-81-160.

In addition to the monitoring of the aquifer formations at hazardous waste sites, significant information can be obtained by sampling the unsaturated zone above the aquifer, called the vadose zone. Leachate from buried vessels or otherwise contaminated water migrates through the vadose zone toward the water table. Samples collected from the vadose zone can indicate the types of contaminants present and can aid in assessing the potential threat to the aquifer before the leachate reaches it and is subsequently diluted.

Vadose zone soil sampling can be an effective addition to the geophysical methods listed previously to aid in the placement of wells or piezometers. The various types of vadose zone monitors can be used to collect water samples for chemical analysis or to detect the direction and velocity of leachate movement. Since these monitors are relatively inexpensive and simple to install, they can begin supplying information before aquifer monitoring is initiated.

The types of vadose zone monitors, their applications in field investigations, and their use in satisfying the requirements of the Resource Conservation and Recovery Act are discussed in a more complete treatment of vadose zone monitoring, "Vadose Zone Monitoring at Hazardous Waste Sites." (EMSL-LV KT-82-018R. April 1983).

Geophysics--

In the designing of monitor well networks, the placement of wells has been done mainly by educated guesswork. The accuracy and effectiveness of such an approach is heavily dependent upon the assumption that subsurface conditions are uniform, and that regional trends hold true for the local setting. However, these assumptions are frequently invalid, resulting in non-representative locations for monitor well placement. If an attempt is made to improve accuracy by installing additional wells, the project may be thrown off schedule, and costs will increase. Such delays are often unacceptable in rapid assessments required at hazardous waste sites. At certain sites, there are also increased safety risks associated with drilling into unknown buried materials, and the risk of contaminating aquifers by the act of drilling.

During the past decade, extensive development in remote sensing geophysical equipment, portable field instrumentation, field methods, analytical techniques, and related computer processing has resulted in a striking improvement in the capability to assess hazardous waste sites. Further, many of these improved methods allow measurement of parameters in the field with continuous data acquisition at traverse speeds up to several miles per hour.

Some of these geophysical methods offer a direct means of detecting contaminant plumes and flow directions in both the saturated and unsaturated zones. Others offer a way to obtain detailed information about subsurface soil and rock conditions. This capability to rapidly characterize subsurface conditions without disturbing the site (much like nondestructive testing used in many production facilities and test laboratories) offers the benefits of lower cost and less risk, and provides better overall understanding of complex site conditions.

Once a spatial characterization of the site is made by these methods, an optimal direct sampling plan may be designed to:

- Minimize the number of drilling sites;
- Locate drilling and monitor wells at representative sites;
- Reduce risk associated with drilling into unknowns;
- Reduce overall project time and costs;
- Provide improved accuracy and confidence levels.

A good overview on the subject of geophysical methods for surveying hazardous waste sites can be found in "Geophysical Techniques for Sensing Buried Wastes and Waste Migration," prepared for EPA by Technos, Inc. (available from the National Water Well Association, 500 West Wilson Bridge Road, Worthington, OH 43085). Six techniques are discussed in that report:

- Ground Pentrating Radar
- Electromagnetics
- Resistivity
- Seismic Refraction
- Metal Detection
- Magnetometry

These six techniques were selected because they are regularly used and have been proven effective for hazardous waste site assessments. The primary tasks to which these methods can be applied include:

- Mapping of natural geohydrologic features;
- Mapping of conductive leachates and contaminant plumes (landfill leachates, acids, bases);
- Location and boundary definition of buried trenches;
- Location and definition of buried metallic objects (drums, pipes, tanks).

Air --

Ambient concentration of volatile and semivolatile organics, trace metals and particular matter in the vicinity of a hazardous waste sites are of particular concern due to their potential impact on human health, welfare and the environnment. Monitoring for these "fugitives" can provide important input concerning the atmospheric path and dispersion of the release, the populations at risk, source strength, and the extent of airborne migration pathways. In this regard, air monitoring performed during hazardous waste site investigations or inspections can be of three basic types: source evaluations, ambient surveys, and personnel monitoring.

Each of the above-mentioned air monitoring types can be conducted on two distinct levels, areas surveys and detailed characterization efforts. The former level involves the use of portable monitoring devices such as the OVA or Hnμ organic vapor analyzers, stain detector tubes or other monitors. Such surveys provide an indication of the presence of various atmospheric hazards for establishing levels of worker protection and also can provide information essential to the second level of the investigation.

The goal of this second level investigation is to quantitatively assess the impact of site atmospheric emissions. The preliminary survey effort along with knowledge of the materials onsite will aid in determining the extent of the program, both for what analyses are necesary and how many samples are required.

The selection of sampling and analyses methods requires close cooperation between the project manager and the designated laboratory. Many sampling methods are available. Their selection depends on the analytical capabilities of the lab and the desired detection limits. Most methods involve the use of pumps, anything from small personnel monitoring pumps to Hi-Vol samplers, to draw measured volumes of air through a filter, impinger, or sorbent. Guidance in methods selection can be found in Volume II - Available Sampling Methods, Volume III - Available Laboratory Analytical Methods, and several other guidance documents referenced below.

In addition to methods selection, considerable planning is required to select the number of samples and the sample locations. Certainly these decisions again depend on laboratory capabilities as well as a number of siting factors, including:

1. Source Characteristics
2. Site Characteristics
3. Meterological Considerations
4. Spatial Scale
5. Temporal Resolution
6. Traffic Distribution
7. Population and Housing Distribution
8. Background Concentrations

Source Characteristics

Emissions may emanate from the area undergoinng excavation and/or treatment at abandonded hazardous waste sites, surface impoundments, landfills, and land treatment facilities. The emissions enter the atmosphere at ground level over an area with field dimensions. Insight into the transport and dispersion of pollutants from an area source can be gained through the application of the Gaussian plume dispersion model to the area source. Although Gaussian plume dispersion is generally appliend to elevated point source releases, it is also valid in an area source situation.

Source characteristics may also be defined through direct measurement of the source strength. Research is being conducted and information is available in the literature concerning a number of techniques that are useful for determining emission rate measurements from landfills, surface impoundments etc. Although more costly than modeling, certain applications may detect that solid, emperical data be collected via direct measurements.

Site Characteristics

The shape and configuration of the area sources, along with the terrain in and around the waste site, play a major role in monitoring network design, Within the boundaries of the waste site, all area sources must be identified. If workers will be in the immediate surroundings of an area source, this location will be a prime candidate for monitoring. Measurements also should be taken along the site boundaries, with a minimum of one monitor per major compass direction (N, S, E, W). This will ensure that no oversight was made in monitor site selection.

Beyond the site boundaries, the terrain features are of major importance. Since the emissions enter the atmosphere at ground level, they are subject to the local drainage flows and chaneling effects induced by the terriain. High ground and open terrain also are vulnerable to air quality impact. A good understanding of the terrain features and land use (e.g., locations of residential and commercial zones) will enter into the meteorological considerations.

Meteorological Considerations

The local meteorological characteristics are of particular importance in siting monitors at waste sites. As with all air emissions, the transport and dispersion of hazardous waste away from the site will be dependent on wind speed, wind direction, and atmospheric stability. Because the hazardous waste emmissions are ground level releases, meteorological parameters characteristic of the first 10 meters above the surface will best define the transport and dispersion process.

In summary, the meteorological parameters of wind speed, wind direction, and atmospheric stability must be considered in the monitorng site selection process. Climatological data are available for stations throughout the United States, and are quite useful. However, because hazardous pollutants are emitted at ground level, the micrometeorology of the waste site must be considered carefully. This can be accomplished, to some extent, in a review by a meteorologist of the climatological data and terrain maps of the region. Ideally, onsite meterological data should be used. If none exists, the network designed must be based on the climatological data and micrometeorological analysis. Onsite meteorology data should be collected from the start of the program, and used to evaluate the initial monitor locations.

Spatial Scale

The objectives of air monitoring at hazardous waste sites necessitate the consideration of two spatial scales. An onsite network must be designed, and air quality in nearby residential and commercial areas must be monitored.

The number and placement of the monitors will be highly site dependent. In general, there should be a monitor in all areas near sources where there is a great deal of activity. In addition, there should be a set of monitors along the site boundaries; the boundary line monitors will record effluent transport and dispersion characteristics.

Beyond the waste site, condsiderations should be given to all commercial and residential areas with a potential for plume impact. The high impact areas will be identified by examining all siting factors including meteorological considerations and proximity of the area to the waste site.

This enables prioritizing the use of the available resources so that all high impact areas are monitored before those which have potentially less impact. If initial readings show significantly high off-site levels or a shift from the initially expected impact areas, monitor locations can be adjusted and/or the base network reinforced.

Temporal Resolution

In scheduling the field program, the time dependence of emmission rate and human activity must be considered. Volatile and semivolatile compounds will evaporate from area sources at the highest rate when the ground temperature is the warmest; sunny, summer afternoons possess the greatest potential for high emission rates. Human activity on the site, e.g., excavation, peaks during daylight hours. Therefore, maximum human exposure is most likely to occur on warm summer afternoons. Consideration should be given to possible concentration buildup during nighttime conditions of lower wind speeds and potential inversions.

Depending upon the compound, length of exposure is of concern. If the critical exposure concern is short-term, summer, daytime monitoring is needed. Estimates of long-term exposure demand an ongoing seasonal or annual monitoring study.

Traffic Distribution

Streets and roadways are sources of possible interference with the measurement of pollutants. If a monitor is located too close to the roadway, the organic compounds in vehicle exhaust will be recorded by the monitor, potentially interfering with the observations. This problem cannot always be eliminated at waste sites undergoing excavation due to the large amount of heavy equipment operating in the area; however, consideration must be given to this concern wherever possible. Also, onsite roadway dust may have a detrimental effect on sampling equipment. Generally, the roadways near the area sources are unpaved. Therefore, the monitors must be sited far enough from the roadway to limit problems with the collected samples and to prevent instrument damage.

Population and Housing Distribution

A primary objective of monitoring near hazardous waste sites is to protect the health and safety of the public. Therefore, land-use maps of the immediate (within 10 kilometers) area surrounding the waste site must be acquired and studied. The land-use maps in conjunction with meteorological considerations will identify which areas have the highest potential for human exposure. Also, appropriate state and local officials should be consulted. There may be neighborhood or commercial zones where complaints are common. If so, these locations should be evaluated as monitor locations.

Laboratory Interface and Coordination

Once the types and numbers of samples have been decided upon, laboratories must be chosen to process them. If the laboratory cannot process the number of samples planned, within specified holding times, or provide the kinds of analyses requested, either additional labs must be located or the sampling strategy revised.

The EPA has established the Contract Laboratory Program (CLP) to provide necessary analytical services through a nationwide network of contract laboratories. The program is structured with a strong orientation towards the needs of enforcement activities. Protocols and methodologies are designed by EPA to provide data of known quality in strict accordance with quality assurance procedures and chain-of-custody, and document control requirements. Although primarily established to analyze samples collected under Superfund, the CLP is currently implementing an accounting charge-back system to accommodate the analytical needs of other programs. All programs utilizing these services automatically receive the intensive quality assurance, chain-of-custody and document control characteristics built in for generating data suitable for litigation. In addition, users of the CLP avoid the administrative burden involved in independently contracting for and managing analytical services on a small scale. Data from these laboratories must be carefully screened, however, to insure that the results fulfill the needs.

The provisions of the Contract Laboratory Program are detailed in a document prepared by the EPA Sample Management Office entitled "User's Guide to the EPA Contract Laboratory Program", August 1982. Additional information can be obtained by contacting the Sample Management Office at 703/557-2490 or FTS/557-2490.

After arrangements have been made to analyze the samples, further coordination will be necessary to select sample containers, precleaning requirements, preservation techniques, labeling and shipping requirements, and schedules.

Volume III lists the volume, recommended container type and preservation requirements for the various methods. More general guidelines are also included in Appendix A of Volume II; however, these are only recommended procedures, and all such matters should be coordinated with the designated laboratory.

Transportation

Packaging and shipping of hazardous waste samples must comply with all appropriate Department of Transportation regulations governing such materials (49 CFR 172.101). Refer to Appendix F, Packaging, Marking, Labeling and Shipping, for a detailed explanation of the required procedures. Refer to the DOT regulations for updates and whenever clarification is necessary.

Organization of the Field Team

The field team's obvious function is to gather technical information to document actual, potential and suspected current and historic releases of hazardous materials. Specific strategy and objectives for incidents and sites are contained in standard operating plans and site-specific work plans. The techniques described in these plans are likely to include hazardous and environmental sampling of all media, inventorying wastes, mapping areas, drilling wells and excavation both on and off site.

There are a small number of incontrovertible guides for field teams which have both technical and safety justifications. They are:

- safety first always;
- someone has to be in ultimate charge during all onsite operations; and
- all potential exposures to hazardous materials require a "buddy" hookup system for onsite operations. "Buddy" system means two trained personnel experienced in working together, who have confidence in each other, and who are working in actual line-of-sight view of each other.

There are some excellent rationales and systems for handling necessary hazardous waste exposure situations in a manner which virtually eliminates personnel exposure and offsite contamination. The one most commonly encountered was developed from the U.S. Army Tech Escort Procedure as modified by Ecology and Environment, Inc. (E and E). This system is based on the need to fill the six roles which may be required for a field investigation team. It was developed for major sites and assumes adequate lead time and a series of checks and balances on individual responsibilities on site.

The following addresses the duties and responsibilities of the six roles:

- Project Team Leader,
- Field Team Leader,
- Site Safety Officer,
- Contamination Reduction Corridor Operator/Equipment Specialist,

- Command Post Supervisor, and
- Initial Entry Party, Work Party, and Backup Team.

Project Team Leader--

The project team leader is primarily an administrator when not participating in the field investigation as field team leader or command post supervisor. The project team leader is responsible for:

- all the team does or fails to do, however, some of this responsibility may be passed to the field team leader and site safety officer;
- preparation and organization of all project work;
- selection of team personnel and briefing them on specific assignments;
- obtaining permission to enter the site from the owner;
- coordinating with the field team leader to complete the work plan;
- completing final reports and preparation of the evidentiary file; and
- insuring that safety and equipment requirements are complete.

Field Team Leader--

The field team leader is responsible for the overall operation and safety of the field team. This role can be filled by the project team leader or a designated representative. The field team leader may join the work party. He is responsible for:

- safety and safety procedure enforcement;
- field operations management;
- public relations/state and federal liaison;
- site control;
- compliance of field documentation and sampling methods with evidence collection procedures;
- execution of the site work plan; and
- determination of the level of personal protection required (in conjunction with the site safety officer).

Site Safety Officer--

The safety officer for the site has primary responsibility for all safety procedures and operations on site. Ideally, the site safety officer will report to the person responsible for safety in the Corporate or Agency organization rather than to the field team leader or project team leader. This allows two separate lines of authority. It allows decisions related to safety to be represented without conflicting with decisions related to the pressures for accomplishing the investigation according to schedule. The site safety officer remains half dressed in the appropriate level of protective equipment to respond to emergencies. He or she stays on the clean side of the exclusion area while monitoring the work party and site activities. The site safety officer is also responsible for:

- updating equipment or procedures based upon new information gathered during the site inspection;
- upgrading the levels of protection based upon site observations;
- enforcing the "buddy system";
- determining and posting locations and routes to medical facilities, including poison control centers, and arranging for emergency transportation to medical facilities;
- notifying local public emergency officers, i.e., police and fire department, of the nature of the team's operations, and posting their telephone numbers;
- controlling entry (if possible) of unauthorized persons to the site;
- entering the exclusion area in emergencies when at least one other member of the field team is available to stay behind and notify emergency services, and/or after he/she has notified emergency services;
- examining work party members for symptoms of exposure or stress;
- determining the suitability of a team member for work in the exclusion area, based on the team member's physical profile which is determined by the health and safety program and the team member's current physical condition; and
- providing emergency medical care and first aid as necessary on site. The site safety officer has the ultimate responsibility to stop any operation that threatens the health or safety of the team or surrounding populace.

Personnel Decontamination Station (PDS) Operator/Equipment Specialist--

The PDS operator/equipment specialist functions in two roles that do not require concurrent attention. As the equipment specialist, he or she is charged with:

- ensuring that all equipment is properly maintained and operating;
- inspecting all equipment before and after use;

- ensuring that all required equipment is available; and
- decontaminating all personnel, samples and equipment returning from the exclusion area.

The PDS operator/equipment specialist is responsible for design and setup for the PDS and for preparing the necessary decontamination solutions to ensure that chemical contamination is not transported into the clean area by inspection equipment, samples, protective clothing or personnel. Failure to properly execute these duties reduces the effectiveness of the protective equipment and threatens the rest of the field team. The PDS operator/equipment specialist also manages the mechanics of removing contaminated clothing from the work party and the proper disposal of discarded contaminated clothing and decontamination solutions.

Command Post Supervisor--

The command post supervisor functions as the clearinghouse for communications. He or she does not enter the exclusion area to assist the work party except for certain emergency situations. Should an emergency arise, the command post supervisor notifies emergency support personnel by phone, radio, etc. to respond to the situation. Depending on the team size and the nature of the emergency, the command post supervisor may, in extreme situations, assist the site safety officer in effecting a rescue. Usually, the command post supervisor may be called upon to assist the PDS operator/equipment specialist in operating the PDS during an emergency, and assist the site safety officer in emergency medical measures. The field team leader may assume the position of command post supervisor.

The command post supervisor is also responsible for:

- maintaining a log of communications and site activities such as duration of work periods with respirators;
- sustaining communication and line-of-sight contact with the work party;
- maintaining public relations in the absence of the field team leader; and
- assisting the site safety officer and PDS operator/equipment specialist as required.

Work Party and Backup Team--

Initial Entry Party--The initial entry party enters the site first, employing specialized instrumentation to characterize site hazards. Usually the field team leader should be a part of the initial entry party to familiarize him/herself with conditions and dangers associated with the site. The major purpose of this team is to measure existing hazards and survey the site to ascertain if the level of personnel protection determined from preliminary assessment and site inspection must be adjusted.

The initial entry party can consist of as few as two people if a wheelbarrow or other device is used to transport all the instrumentation. Three or four people are able to do the job more efficiently.

Work Party--The work party performs the onsite tasks necessary to fulfill the objectives of the investigation, e.g., obtaining samples or determining locations for monitoring wells. No team member should enter or exit the exclusion area alone. The work party consists of a minimum of two individuals, and any work party should follow this buddy system. Besides the safety considerations, it is much easier for two persons dressed in protective clothing to perform such tasks as note taking, photographing, and sampling.

Backup Team--Extensive assignments requiring long hours and large work parties (more than five members) necessitate the use of a standby backup team. The emergency response team is halfdressed in protective gear so that it can quickly enter the exclusion area in the event of an emergency. This team is particularly valuable at dangerous sites where protective equipment produces stress and heat loads on the work party.

Mitigating Considerations for Field Team Size Adjustments--

The system outlined above is reasonably comprehensive and basically fail safe. It could be applied to nearly any situation assuming adequate notice and resources were available. It does not, however, recognize the structure, skills, resources and range of incidents encountered by Agency field teams. All of the decision points, responsibilities and skills outlined above need to be covered in any hazardous exposure situation, but there are numerous factors which could cause the number of hands on scene to be legitimately increased or decreased.

These factors are described below with examples:

- Contamination of Samples - Proper collection of environmental samples for low detection limit analyses may require higher skill levels or more numerous hands than the work plan would indicate.

- Physical Work - Sites or other activities which involve manual collection or core samples, use of Peterson dredges, and performance of similar manual work may require a skills mix and number of hands not anticipated by the work plan.

- Cost Effectiveness - For longer distance trips where travel costs are high, it may be desirable to consider overtime and additional per diem for a smaller number of personnel than would normally be assigned for a given job.

- Chain-of-Custody and Documentation Considerations - Collection of enforceable data is essential. There are instances where additional personnel are required on scene for witness purposes or to manage such things as photographic documentation of data collection efforts.

- Logistics/Areal Extent - There are frequently instances involving such things as dye studies, releases to rivers, and searches for leachate seeps where the terrain and physical distances involved require additional manpower even when optimal use is made of portable radio communications.

- Problem Complexity/Skills Mix - Certain onsite situations require additional personnel onsite with the proper academic background and experience to evaluate the problems. Commonly this situation occurs with releases of potentially toxic organics to shallow ground-water regimes where many disciplines may need to interact to provide competent assessments. At the same time, fortuitous combinations of experience and skills onsite and effective communication with offsite expertise may radically reduce optimal team size for any given situation.

- Other mitigating factors:

  - Safety - Responses to sulfuric acid spills, for example, may not require the same resources as responses to a similar quantity of dioxin or parathion.

  - Training - On-the-job-training is frequently employed to improve skills of entry level and less experienced employees. Opportunities for this type of training should be used as often as possible where it is not perceived as wasting resources.

  - Time Constraints - Hurry up jobs are generally done more quickly by more people.

  - Visibility - When extensive tourists or media are expected in the vicinity, appropriate resources should be assigned to handle these contacts without inhibiting technical operations.

- Average Team Size for Normal Operations - There are general guidelines for determining team size in terms of commonly encountered situations. These team size discussions presented below are couched in terms of the protective safety required.

  - Two-Person Team - The two-person team is the minimum for a hazardous substance site investigation. The two-person team is best suited for offsite surveys and inspections or for obtaining environmental (nonhazardous, offsite) samples. Collection of ground truth data for aerial photographic surveys, inspection of files, or interviews can all be accomplished by the two-person team.

    Two-person teams are standard for initial responses to situations where imminent hazards may exist. However, in this situation, team members are generally more completely trained and equipped for reducing the risk of accidental exposure. They are also instructed to utilize available safety gear in a very conservative approach to the hazards and are commonly backed up by local government emergency units.

- Three-Person Team - The three-person team can be employed on sites requiring Level C protection and in some cases, on sites requiring Level B protection. Level of protection requirements are discussed in Section 3. This team is composed of a field team leader; an individual fulfilling the combined functions of PDS operator/equipment specialist, site safety officer, and command post supervisor; and another individual to enter the site with the field team leader.

  The three-person team is used where extensive PDS procedures are not required and where the liklihood of emergency rescue is low. This field investigation team is best utilized in non-IDLH (immediately dangerous to life and health) atmospheres where the primary objective is to map, photograph, or inventory. Its use assumes that at no time will the work party be exposed to hazardous situations.

  Considerable care and thought are necessary before a three-person team is employed on a site because each individual has numerous responsibilities. In the event of an accident, the third member does not enter the site to offer emergency assistance until he has summoned outside assistance, and even then, only when he feels rescue will not endanger his own life.

- Four-Person Team - Most Level B and some restricted Level A operations can be conducted with a four-person team. These operations would include work on active sites where facility personnel are present or on inactive sites with potentially IDLH atmospheres. The objectives of a four-person team at a site requiring Level B or Level A protection might include sampling ponds, soils, or open containers, and performing inspections at sites known for poor housekeeping, i.e., where there is evidence of spills, leaks, etc.

  The team consists of the standard two-person work party, a combination site safety officer/PDS operator/equipment specialist, and a command post supervisor who may assist in the PDS operation. Because life-threatening hazards are assumed or known to be present at a Level B or Level A site, it is essential that all personnel be fully acquainted with their duties. During an emergency, the command post supervisor stays in the support area to maintain communication while the site safety officer/PDS operator/equipment specialist enters the exclusion area to aid the work party. Once the work party is in the contamination reduction area, the command post supervisor can then offer assistance at the PDS or provide fresh equipment from the support area.

- Five-Person Team - The five-person team is minimum size for most Level A and certain Level B operations or for operations where percutaneous hazards are known to exist or where there is an absence of historical information. The site hazards that require Level A protection, combined with the limitation and stresses placed on personnel by wearing Level A protection, necessitate a full-time PDS operator/equipment specialist who can also serve in emergency response. In the event of a serious emergency such as a fire, explosion, or acutely toxic release, both the site safety officer and PDS operator/equipment specialist may need to enter the exclusion area dressed in Level A gear. The command post supervisor remains in the support area to direct outside help to the site and then assume the functions of PDS operator/equipment specialist.

- Teams of Seven or More - Certain hazardous substance sites requiring sampling operations necessitate larger or alternating work parties and additional support personnel in the contamination reduction area. The seven-person team employs the basic five-person structure plus an additional work party for alternating work loads. The eight-person team includes an additional PDS operator/ equipment specialist to assist in the continuous decontamination tasks involved with alternating work parties, and to decontaminate and pack samples as they are received.

  It is not unusual to employ teams of 12 where such tasks as drum opening may require three work parties downrange working concurrently. This operation may involve teams to move the drums, open the drums, and sample and then reseal under rigorous safety procedures. Larger teams can be designed with additional work parties and support personnel to safely gather the site data and insure communication and site control.

Organization of the Operations Area

General Considerations--

The investigation of a hazardous substance site introduces the risk of exposure of the field team and surrounding community to varying degrees of hazard. One way to decrease the possibility of exposure is to organize an operations area which includes a buffer zone around the site and a security system that can control access to it.

The area regarded as contaminated or hazardous must be delineated and isolated. The actual hazardous substance site can vary in area from a few yards to several square miles. The extent of the site is initially established from data collected during the preliminary assessment phase of the investigation.

The use of aerial photography is helpful in establishing the site boundaries by identifying evidence of contamination such as:

- the presence of drums, tankers, lagoons, ponds, or other areas which contain hazardous substances;

- spills, leaks, puddles, leachate outbreaks or other evidence of uncontained hazardous substances; and
- the presence of distressed vegetation, previously noted odors, discolored soil, parts of containers (i.e., drum lids, bungs) or other indications of contaminants or deliberate dumping of containers.

Once the extent of the contamination or possible threats to the surrounding community have been evaluated, the hazardous substance site can be delineated. A buffer zone is added for additional safety, and the entire area (hazardous substance site plus buffer zone) is regarded as "hot" or contaminated. This zone is known as the exclusion area, which should be physically secured, fenced, posted, readily identifiable by topographical boundaries, or marked in some way.

The area surrounding the exclusion zone is considered clean or noncontaminated, and serves as the support area from which operations into the exclusion area are conducted. Activities such as dressout in protective clothing, equipment maintenance and repair, communications, liaison with authorities and the media, and medical aid are conducted in the support area.

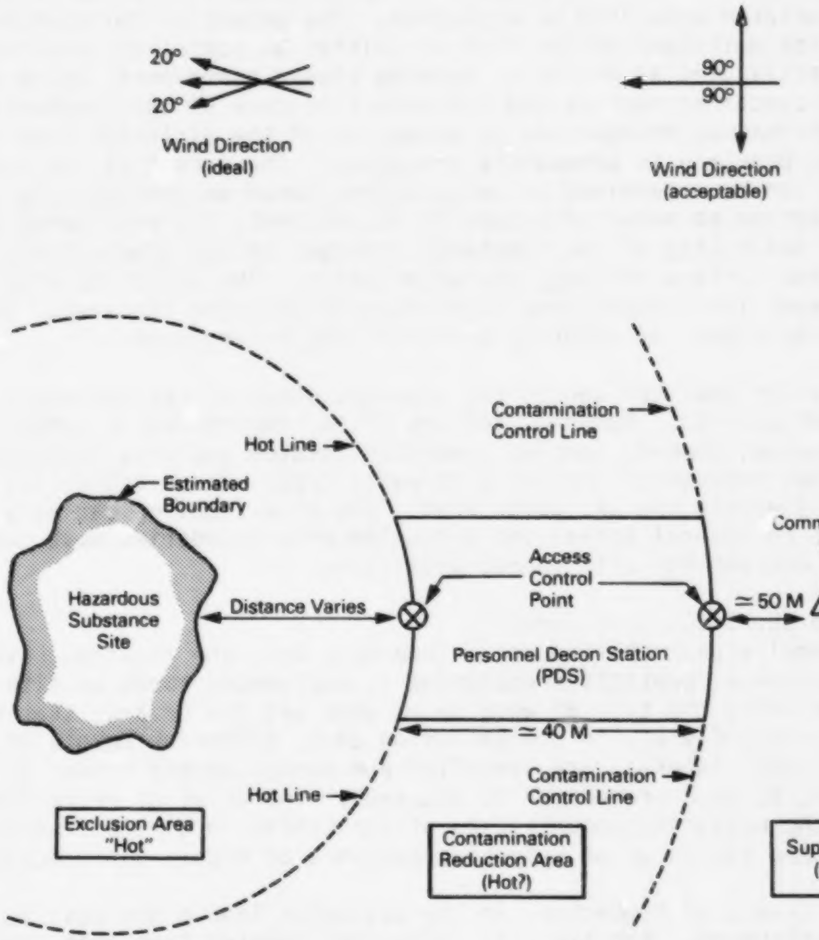
An area devoted to contamination reduction should be established between the exclusion area and the support area. This zone exists for the decontamination of personnel, equipment and samples returning from the exclusion area and is designed to prevent movement of contaminated material into the support area. Vehicles, equipment, structures, and personnel in the support area not previously subject to exposure are protected by this practice.

These three zones - the exclusion area, the support area, and the contamination reduction area - are the basic organizational blocks of an operations area (Figure 7-1).

Exclusion Zone--

The exclusion zone contains those areas considered contaminated, possibly contaminated, or capable of being contaminated in the event of fire, explosion, or toxic release. A buffer zone is also included for additional safety. The initial boundaries of the exclusion area are established from data collected during the preliminary assessment and prior to site contact by any members of the investigation team. This assessment should include the following basic information:

- types of hazardous substances present;
- quantity of hazardous substances present;
- type of storage containers used on site;
- condition of storage containers;
- toxicity, flammability, explosiveness, flashpoint/auto-ignition point, and corrosivity of the material; and
- presence or absence of radioactive materials.



NOTE: Distances are approximate and can vary.

Figure 7-1. Organization of the operations area.

This information is used to determine those areas that are contaminated or probably contaminated.

The area of probable contamination delineates only a portion of the exclusion area; the remainder is determined by the potential airborne hazard or the hazard associated with fire or explosion. The potential for airborne hazard can be insignificant during such activities as container inventory. However, such activities as moving or opening closed containers, where the possibility of container rupture and subsequent release of toxic materials is dramatically increased, necessitate an expansion of the exclusion area so that any surrounding populace is adequately protected. The extent of the expanded exclusion area can be determined by calculations based on the toxicity of the material, the estimated amount released in an accident, the wind speed and direction, the volatility of the substance, changes in the temperature, and the local terrain and surface drainage characteristics. The exclusion area should be secured to prevent individuals from inadvertently entering the area. Fences, barriers, warning signs, or security personnel may be employed.

Another factor that influences the size and shape of the exclusion area is the type of work planned. Remedial actions often require that a number of containers be moved, opened, sampled, resealed, staged awaiting laboratory results, and then segregated according to waste type. These activities must occur completely within the exclusion area. The area required can vary from a few square feet to several acres; the exclusion area boundaries must therefore be adjusted to account for all planned activities.

Subareas Within the Exclusion Zone--

All personnel within the Exclusion Zone must wear the required Level of Protection. Personnel protective equipment is designated based on site-specific conditions, including the type of work to be done and the hazards that might be encountered. Frequently within the Exclusion Zone, different Levels of Protection are justified. Subareas are specified and conspicuously marked as to whether Level A, B, or C protection is required. The Level of Protection is determined by the measured concentration of substances in air, potential for contamination, and the known or suspected presence of highly toxic substances.

Different Levels of Protection in the Exclusion Zone might also be designated by job assignment. For example, collecting samples from open containers might require Level B protection, while for walk-through ambient air monitoring, Level C protection might be sufficient. The assignment, when appropriate, of different Levels of Protection within the Exclusion Zone generally makes for more flexible, effective, and less costly operation, while still maintaining a high degree of safety.

Contamination Reduction Zone--

The contamination reduction zone lies upwind of the exclusion area, between it and the support area. The contamination reduction area provides an area for the decontamination of personnel, equipment, and sample containers used within the exclusion area, and for the execution of certain functions (air tank changes, equipment staging, etc.) to assist the work party. The contamination reduction area is initially established in an assumed clean area, but is considered to be possibly contaminated as soon as the first items or people are processed through the personnel decontamination station (PDS). While some gross decontamination may occur while the work party is in the exclusion area, most decontamination will occur within the contamination reduction area. It should be noted that provisions must be made to handle the decontamination solutions and other materials generated as wastes during the onsite investigation. This usually requires temporary secure storage until proper ultimate disposal at a permitted facility.

The boundary between the contamination reduction area and exclusion area is known as the hot line. Everything within the hot line is considered contaminated. The hot line should be clearly delineated by flagging tape, engineer's tape, paint, or other prominent, easily discernable marking devices. The access control point is the only entrance to and exit from the exclusion area used by team members, although other emergency exits should be established and clearly marked on sites that are restricted or congested or where there is possibility of fire or explosion.

Anyone crossing the hot line into the exclusion area must wear the proper protective equipment. If a property owner, official, or other non-team individual enters the area, the individual must be warned of the hazards he may be facing. Individuals leaving the exclusion area must be processed through the PDS. A separate PDS for samples can be established; a "mini-PDS" for the PDS operators can also be established nearer the support area so that they can decontaminate themselves before entering the support area.

The boundary between the support area and the contamination reduction area is known as the contamination control line. An access control point is established for entrance and for exit to the contamination reduction area. Personnel entering the contamination reduction area must be dressed in the proper personal protection equipment for work in that area; people exiting to the support area must have been properly decontaminated.

Initial Planning--

The initial decontamination plan assumes all personnel and equipment leaving the Exclusion Zone (area of potential contamination) are grossly contaminated. A system is then set up to wash and rinse, at least once, all the personnel protective equipment worn. This is done in combination with a sequential doffing of equipment, starting at the first station with the most heavily contaminated item and progressing to the last station with the least contaminated article. Each piece of clothing or operation requires a separate station.

The spread of contaminants during the washing/doffing process is further reduced by separating each decontamination station by a minimum of three feet. Ideally, contamination should decrease as a person moves from one station to another farther along in the line.

While planning site operations, methods should be developed to prevent the contamination of people and equipment. For example, using remote sampling techniques, not opening containers by hand, bagging monitoring instruments, using drum grapplers, watering down dusty areas, and not walking through areas of obvious contamination would reduce the probability of becoming contaminated and require a less elaborate decontamination procedure.

The initial decontamination plan is usually based on a worst-case situation. During the site inspection specific conditions at the site are then evaluated, including:

- type of contaminant;
- the amount of contamination;
- levels of protection required; and
- type of protective clothing worn.

The initial decontamination system is then modified, eliminating unnecessary stations or otherwise adapting it to site conditions. For instance, the initial plan might require a complete wash and rinse of chemical protective garments. If disposable garments are worn, the wash/rinse step could be omitted. Wearing disposable boot covers and gloves could eliminate washing and rinsing both gloves and disposable boots and reduce the number of stations needed.

Contamination Reduction Corridor--

An area within the Contamination Reduction Zone is designated the Contamination Reduction Corridor (CRC). The CRC controls access into and out of the Exclusion Zone and confines personnel decontamination activities to a limited area. The size of the corridor depends on the number of stations in the decontamination procedure, overall dimensions of work control zones, and amount of space available at the site. A corridor of 75 feet by 15 feet should be adequate for full decontamination. Whenever possible, it should be a straight path.

The CRC boundaries should be conspicuously marked, with entry and exit restricted. The far end is the hotline--the boundary between the Exclusion Zone and the Contamination Reduction Zone. Personnel exiting the Exclusion Zone must go through the CRC. Anyone in the CRC should be wearing the Level of Protection designated for the decontamination crew. Another corridor may be required for the entrance and exit of heavy equipment requiring decontamination. Within the CRC, distinct areas are set aside for decontamination of personnel, restricted to those wearing the appropriate Level of Protection. All activities within the corridor are confined to decontamination.

Personnel protective clothing, respirators, monitoring equipment, sampling supplies, etc. are all maintained outside of the CRC. Personnel don their protective equipment away from the CRC and enter the Exclusion Zone through a separate access control point at the hotline.

Support Area or Clean Area--

The support area is the outermost part of the site and serves as the location for the command post and other support activities. After ensuring that the support area is located in a non-contaminated area, the most important considerations for the location of the support area include the following:

- Wind Direction and Speed

The support area should be upwind of the exclusion area. Ideally, the support area will be located such that the wind is blowing at 3 miles per hour or more directly away from the support area toward the exclusion area, with no more than 20° deviation in direction to either side of a straight line between the support and exclusion areas. Wind direction can shift because of local conditions (for example, onshore and offshore breezes near the ocean, lakes or large rivers, or upslope and downslope breezes in the mountains); changes in the weather (thunderstorms, frontal passages); climatic conditions (chinooks, Santa Ana winds); or local terrain and topography (swirling and turbulence with increased wind speed). These conditions should be evaluated during the preliminary assessment phase of the investigation, and plans made to compensate for wind shifts. While the 40° arc of wind variation represents the ideal, in actuality, up to 180° can be tolerated. This would place the wind blowing away from both the hazardous substance site and the support area. This effectively leaves the team leader with a 180° arc within which the support area can be placed.

The location of existing access points to a site may make it necessary to place the support area downwind of the site. This problem should be addressed during the preliminary assessment phase. Other access points can usually be obtained through the use of warrants, discussions with property owners, and minor, easily repairable modifications to barriers or fences. If an upwind location cannot be found, the team leader may choose to locate the support area far enough downwind from the hazardous area to allow a decrease in the concentration of airborne contaminants. Continual air monitoring and the wearing of respiratory protection by all team members located within the support area may be necessary. The resulting decrease in worker efficiency must be weighed by the team leader before the decision is made to locate the support area downwind. Wind direction indicators (4-ft stakes with 18 in. of flagging tape) should be placed throughout the operations area.

- Line of Sight

Personnel in the support area should have visual contact with all activities occurring within the contamination reduction area and the exclusion area. However, where local topography restricts vision, the team can use an observer in an elevated position (building, tree, vehicle) or "floaters" (individuals who enter the exclusion area to maintain line-of-sight, but who do nothing else). Another possibility is to attach lightweight 4-foot-long poles with flags to members of the work party.

- Terrain

  The support area should be located to take advantage of the terrain so that:

  - Safe avenues exist to and from the exclusion area;
  - There is easy access to the support area for emergency vehicles;
  - The boundaries of the various site areas are keyed to easily discernible landmarks;
  - Access to the site can be controlled by the support area personnel; and
  - Shelter can be easily provided for returning work party members.

Additional considerations for the location of the support area include susceptibility to lightning, proximity to powerlines or other interferences to communications, and sufficiency of space for all support area functions.

- Location of Water, Communications and Power

  The PDS requires a sufficient water supply for cleaning and maintenance. Ideally, a clean, dependable water source will be located in the support area (fire hydrants, community water system, etc.), but water can be brought to the support area in clean 55-gallon drums, fire department tankers, or a collapsible swimming pool filled and left onsite. Alternately, ground water or adjacent lakes and streams can be utilized provided they have been tested.

- Hopefully, the support area will also have access to a telephone, either existing or installed by means of a drop line brought onsite. If the investigation will involve more than a few days onsite, a telephone is virtually a necessity and probably cost-effective. In addition, electrical power for lighting, equipment maintenance, laboratory work, and personal comfort is desirable, but not necessary. A drop line can be brought onsite or a portable generator can be used, if necessary. Again, long term operations will require more elaborate preparations.

- Location of Inhabitants and Developed Areas

  If the hazardous substance site is in a developed area, the boundaries of the operations areas may have to be compressed to prevent including inhabitants in the exclusion area or contamination reduction area. Ownership of the property within the operations areas must be determined during the preliminary assessment, so that permission to use the land can be obtained. It must be noted that an owner's right of access to his/her property and his/her right to defend such property from intruders are basic tenets of the law. Accordingly, the team has little recourse in preventing property owners from entering an operations area located on their property. Skillful negotiations, or the withdrawal of the team if health or safety is threatened, are often the only alternatives available. In cases where the surrounding community may be placed in danger from site operations such as container movement or opening, a public evacuation should be considered. Provisions for such situations should be included in the community relations plan formulated as part of the sampling plan. Proper and complete implementation of the community relations plan will ensure that an active framework exists to reduce public anxiety and ensure their safety.

Other Considerations--

The use of a three-zone operations area with carefully delineated boundaries, access control points, and decontamination stations provides assurance against the removal and distribution of contaminated materials from the exclusion area. Such a system requires an adequate number of personnel and the proper equipment to operate the system effectively and necessitates the expenditure of some time to set up and break down. Under certain circumstances, a less exacting site control system may be established and the decontamination procedures modified.

Onsite Analyses--

Frequently it will be necessary or desirable to conduct certain analyses in the field. These analyses may range from simple colorimetric titrations (sulfite, carbonate) or instrumental measurements (pH, conductivity) to complex instrumentational analysis (PCB's, pesticide), that require elaborate onsite laboratory space.

Onsite analyses should be conducted in the support area (clean area) in order to limit the effects of inadvertent sample contamination, and to minimize exposure of the analyst. In situations where precautions cannot ensure the containment of hazardous materials, and testing may result in an accidental release onsite, analyses should not be conducted in the support area. This situation may arise during certain drum compatibility and consolidation protocols.

Planning for the use of onsite laboratories must consider provisions for utility hook up, control and disposal of generated and residual waste, and facility decontamination upon termination. Additionally, the site safety plan must address such laboratory operations and provide a means to alert other onsite personnel in the event of accident or injury to the onsite laboratory analysts.

The testing of potentially hazardous materials such as drum or impoundment contents for compatibility or consolidation protocols is a common on-site analysis program. Occasionally, these protocols can be employed directly onsite without the need for a mobile laboratory. Two characterization protocols are presented in Appendix E. They include the specific equipment and materials necessary for onsite implementation.

Recommended Equipment Inventory

Appendix D contains a suggested inventory of equipment needed for a variety of hazardous site field operations. Since the collection of samples is a major field investigative activity, specialized sampling equipment is included. The personnel safety equipment list is applicable to a wide range of field operations.

Although no list will include everything that is necessary to perform a field investigation, the Appendix D list is basic and includes the equipment necessary to perform most field investigations. It is anticipated that this inventory will be updated as hazardous site investigate technology advances.

Field Communications

General--

A reliable field communications system is required to ensure rapid response to emergency situations and to enhance the effectiveness of the field investigation team. Just how complex the communications system should be is variable and depends upon the task at hand, the nature of the hazard present, the terrain, and types of other resources present. In most cases, the field team can use public telephones to communicate offsite; (management center, hospitals, fire department, etc.); however, a specialized network must be established for internal communications. Communications are complicated by the difficulties in hearing and speaking that are created by protective equipment, the distance involved at a work site, and logistics of communicating with a large group of people.

The communications center is located in the command post and consists of two networks: an external network, used primarily for obtaining offsite emergency aid, and an internal network, used for both emergency and work-related communications. At least two means of communication should be available in each of the networks. Communication methods are limited solely by the resources available and the imagination of the team members.

External Network--The external network is to maintain contact with the surrounding community and the next higher level of authority of the field investigation team. The external network must include the local emergency services (fire department, police, sheriff, ambulance, emergency response technicians, hospital) and can be expanded to include such elements as the state police, the Treasury Department, or Armed Services Explosive Ordinance Disposal units.

The external network is used primarily for summoning emergency aid. Local emergency warning networks (severe weather, fire) should be accessed as part of the external communications network. The external network must be reestablished and tested each working day before any work commences in the exclusion area. This event is recorded in the site log.

Internal Network--The internal network is used to maintain contact among the various elements of the field investigation team. It is used to alert the team to emergencies, to pass along safety information (weather conditions, time downrange), to communicate data regarding the site, and to direct the activities of the team. The primary elements in the network are the command post, the downrange work parties, and the safety officer. If radios are used (and officer resources permit it), each member of the work party, the safety officer, and command post should be equipped with a radio. If resources are limited, the command post should have a radio that can be accessed by the safety officer and the work party can share a radio.

The equipment used in the internal network should be tested each working day before anyone is allowed to enter the exclusion area. If visual or audible signals are used, the meaning of the various signals should be reviewed before work commences. These events are recorded in the site log.

Emergency Communications System--The emergency communications network is made up of both the internal and external networks. The emergency network is distinguished by the signals used, which are to be used solely in emergency situations. Table 7-1 presents these signals; others may be determined by the team.

Means of Communication--

The various means used by the team to establish the networks are limited solely to the resources available and the imagination of the team. Regardless of the type of communications device used, at least two means of communication (a primary and backup) should be available on each network. This redundancy provides that safety margin that could prove invaluable in an emergency.

Standard Telephones--The feasibility of having a temporary drop line installed should be investigated if lengthy operations are anticipated. A messenger (local person) with a means of transportation and correct change or access to a phone can be used in an emergency; each team member should also know the location of the nearest phone and should have the necessary change. A direct line to the local authorities (fire, police, poison control center, hospital) can also be installed, when radio telephones are available.

Radios--There are two basic types of commercially available radios useful in hazardous substances investigations: citizen's band (CB) and FM radio. Their capabilities and limitations are presented in Table 7-2. Any radio used downrange must be intrinsically safe because of the posibility of encountering an explosive atmosphere.

The Environmental Protection Agency currently uses both high- and low-band FM radios. Standard radio procedures should be used at all times. These include use of the phonetic alphabet and call signs to ensure that all transmissions are clear and understandable.

Field-Expedient Devices--As backup measures to telephone and radio, several field-expedient measures are available. These include simple arm and hand signals and noise-making devices such as bells and whistles. Remember that any device used downrange must be intrinsically safe to avoid creating a spark in an explosive atmosphere. The uses of such devices are discussed in Tables 7-1, 7-2 and 7-3.

IMPLEMENTATION OF THE SAMPLING PLAN

Field investigations are conducted after the offsite and onsite reconnaissance has been completed and all inputs, data, information, etc., have been thoroughly assessed. The Sampling Plan will define and specify the scope,

TABLE 7-1. EMERGENCY COMMUNICATIONS

Emergency Communications Method	Signal	Meaning
Hand Signals	Clutching throat	Personal distress
	Hand waved in circle above head	Need assistance (if downrange), or evacuate area (if given to downrange personnel by command post)
Audible (Horn, whistle, etc.)	Three short sounds followed by a pause, repeated	Emergency exists; evacuate downrange area or send assistance downrange
Radio	Each team should develop a consistent, unmistakeable signal such as "Code Red" or "Flash" to clear the communications channel for emergency use	

logistics, schedules, manpower, and equipment needs. The Sampling Plan should be followed unless unforeseen circumstances warrant modification. The investigation must produce data to verify that a problem exists or does not exist. Environmental samples collected during the preliminary inspection may provide insight as to contaminants present, but may also indicate that problems are not significant. The field investigation should be designed to confirm and/or refute the preliminary assessment, and will be complete only when the objectives of the Sampling Plan are met.

All participants in the field team should be completely familiar with the project and their responsibilities during the investigation. A briefing session should be held before (night before, for example) beginning the investigation. The field investigation should be conducted methodically with all leads confirmed and documented in the logbook.

TABLE 7-2. RADIO CAPABILITIES AND LIMITATIONS

Radio Type	Capabilities	Limitations
Citizen's Band (CB)		
Base Station	40 Channels, power for transmission to 25 miles; cheap; maintenance fairly easy. Often monitored by local emergency services.	(Both Types) Channels accessible to anyone with comparable unit; often subject to interference from local traffic; not intrinsically safe for work in explosive atmosphere.
Handheld	Up to 40 channels; 5 or fewer channels more common; usual range one mile; cheap and readily available.	
Frequency Modulated (FM)		
High Band	Specific assigned frequency for each user; little interference; can be made intrinsically safe. Range of 1 to 10 miles, line of sight; ancillary equipment can give user ability to operate unit enclosed in fully encapsulated suit.	(Both Types) Expensive; skilled maintenance and repair required.
Low Band	As above, but range up to 25 miles.	

TABLE 7-3. FIELD-EXPEDIENT COMMUNICATION DEVICES

Device	Users
Audible	
Compressed Air Horn	Command post (CP) or downrange party
Vehicle Horn	CP only
Bell (cow bell, school bell)	CP or downrange
Whistle	CP only
Siren (hand cranked)	CP or downrange
Other (hammer and garbage can lid, etc.)	CP or downrange (NEVER use hazardous waste container as noisemaker)
Megaphone	CP only
Public Address System	CP only
Sound Powered Intercom	CP or downrange (if intrinsically safe)
Visual	
Smoke, Flares or other Pyrotechnics	CP only
Flags, Colored Panels	CP or downrange
Signal Boards	CP or downrange
Lights	CP or downrange (must be bright and intrinsically safe)
Arm and Hand Signals	CP or downrange

Onsite Safety

Implementation of the Safety Plan--

Before beginning any onsite activities, the Health and Safety Plan must be implemented. All personnel must be part of the medical surveillance program and made aware of the provisions of the plan (Section 3). Upon arrival, the operations area should be delineated and the decontamination and emergency medical stations established.

Because safety is a high priority consideration in conducting hazardous waste site investigations, it is imperative that the team be fully briefed before entering the site. Each member must know which activity he and the others will be performing and what protective clothing and safety precautions are required. Sampling procedures (Volume II), and packaging and shipping procedures (Appendix F, Volume I) should be reviewed and discussed. Background material should be reviewed and the team informed of the suspected hazardous waste to be sampled. The team should be encouraged to ask questions, and their suggestions should be implemented if the task will be made safer.

The team should be informed that independent actions are not allowed. All mapping, sampling, and packaging will be done at scheduled times; no one is to wander onsite or offsite without the permission of the team leader.

During the field investigation, if circumstances require deviation from the procedures established in the sampling, the team should be briefed and suggestions solicited.

Field Testing for Onsite Safety--

The safety officer should conduct a preliminary onsite evaluation prior to initiation of onsite activities. Additionally, he should monitor the site on a periodic basis to evaluate the levels or worker exposure and the required personal protection. These techniques are more fully addressed in Section 3 and in Volume II.

Limiting Public Access--

Implementation of the project plan must emphasize safety not only for onsite personnel but for the general public. Access to the site must be controlled. Contact by the public with hazardous waste, or suspected areas of contamination should be eliminated. Any public or private roadways or paths into the site should be blocked to prevent inadvertent contact by passersby. Depending on the extent of the site and the extremity of the action deemed necessary, the limiting of public access to the site may require manned roadblocks or evacuation of public and private buildings. Smaller sites should at least be enclosed with a fence (i.e, 8 foot chain link with barb wire). Approaches to the site from all directions should be clearly posted with signs such as NO TRESPASSING, DANGER, HAZARDOUS AREA. Following establishment of the site perimeters, entry to the site will be controlled by the project leader from the command post. Again based on prior reconnaissance and specifications of the project plan, controlled access can be maintained simply by locking a gate or by employing round-the-clock guards with regular patrols of the site interior and perimeter.

Fire Risk, Access Lanes, Piles, Buildings--

Operations at many sites contain areas or structures or include activities that are fire risks. For safety concerns alone, it is important to keep access lanes open at all times. Clear access routes to and within the site must be maintained for onsite worker safety and for emergency units responding from offsite. Surface structures, buildings, debris, or waste piles should be inspected, and if sufficient risk is present, appropriate areas should be made off limits to normal operations. Emergency access/escape procedures for these areas should be developed. Site survey instruments such as combustible gas/vapor indicators radiation detectors, oxygen meters, or hydrocarbon analyzers will assist in these evaluations.

Sample Collection

Sample collection at hazardous wastes sites is complicated by two primary factors. First, the presence of hazardous materials requires safety precautions and a detailed and deliberate sampling plan. Second, the sensitivity of many of the desired analyses requires careful sample collection to insure representativeness and to reduce cross contamination by other samples or the site environment.

Volume II in this series contains sampling methods which are particularly suited to these situations. In some situations, however, more specific techniques are available, and these may be required by the sampling plan.

Control of Contaminated Materials

General--

For the purpose of this section, "contaminated materials" are defined as any byproducts of a site investigation that are suspected or known to be contaminated with hazardous substances. These byproducts include such materials as decontamination solutions, disposable equipment, drilling muds, well-development fluids, and spill-contaminated materials.

The permitting procedures for hazardous site investigations are not clearly defined at present. In the absence of a clear directive to the contrary by the EPA and/or state government, it must be assumed that hazardous waste generated during investigations must be handled in compliance with the requirments of the Resource Conservation and Recovery Act (Public Law 94-580). In addition, there may be state regulations that govern the generation, storage, transportation, and disposal of hazardous wastes. Consequently, this section will describe only the technical elements of the control of contaminated materials.

The project plan for a site investigation must include a description of control procedures for contaminated materials. This plan would assess the type of contamination, estimate the amount that would be produced, describe containment equipment and procedures, and specify storage or disposal methods. As a general policy it is wise to select investigation methods that minimize the generation of any contaminated materials. Handling and disposing of potentially hazardous materials is often an expensive and dangerous operation. Until sample analysis is complete, it is assumed that all materials generated during the investigation will be contaminated.

Sources of Contaminated Materials and Containment Methods--

Decontamination Solutions--All decontamination solutions and rinses must be assumed to contain the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. The solution volumes could vary from a few gallons to several hundred gallons.

Used rinse solutions from the personnel decontamination station (PDS) are best stored in appropriately marked 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility. Larger equipment such as backhoes and tractors should be decontaminated in an area provided with an impermeable liner and a liquid collection system, such as a berm-enclosed concrete pad with a floor drain leading to a buried holding tank.

Disposable Equipment--Disposable equipment which could be contaminated during a site investigation typically includes rubber gloves, boots, broken sample containers, laboratory tissues, etc. These items are small and can easily be contained in appropriately marked 55-gallon drums with lids. These containers should be closed at the end of each work day and upon project completion to provide secure containment.

Drilling Muds and Well-Development Fluids--The installation of ground-water monitoring wells often involves the use of drilling muds and/or well-development fluids that can result in the surface accumulation of potentially contaminated fluids requiring containment. The volumes of these products will vary and will depend largely on the type and size of the well and the associated geo-hydrological characteristics encountered. Experienced and reputable well drillers familiar with local conditions and the well installation techniques selected should be able to anticipate the types and sizes of containment structures required.

Drilling fluid (mud) and development fluids are mixed and stored in a container commonly referred to as a mud pit. This mud pit consists of a suction section from which drilling fluid is withdrawn and a settling section to which drilling fluid is returned. The fluid is pumped through hoses down the drill pipe to the bit and back up the hole to the settling section of the mud pit.

The mud pits may be either portable above-ground tanks which would easily isolate the natural soils from the contaminated fluids, or stationary, suitably lined, in-ground pits. If in-ground pits are used, they should not extend into the natural water table.

When either an above-ground tank or an in-ground pit is used, a reserve tank or pit should be onsite as a back-up system for leaks, spills, and overflows. In either case, surface drainage should be such that any excess fluid could be controlled within the immediate area of the drill site.

Spill-Contaminated Materials--A spill is always possible when a site investigation involves opening and moving containers of liquids. Contaminated sorbents and soils resulting from spills will have to be contained. Small quantities of spill-contaminated materials are usually best contained in drums, while larger quantities can be placed in lined pits or in other impermeable structures. In some cases onsite containment may not be feasible, and immediate transport to an approved disposal site will be required.

Disposal of Contaminated Materials--

Actual disposal techniques for contaminated materials are the same as those for any hazardous substance, i.e., incineration, landfilling, treatment, etc. The problem centers around assignment of responsibility for disposal. The responsibiltiy must be determined and agreed upon by all involved parties before the field work starts. If the site owner or manager was involved in activities that precipitated the investigation, it seems reasonable to encourage his acceptance of the disposal obligation. In instances where a responsible party cannot be identified, this responsibility may fall upon the public agency or private investigating organization.

Scheduled post-investigation site cleanup activities offer an alternative disposal method. For example, if construction of a suitable onsite disposal structure is anticipated, contaminated materials generated during the investigation should be stored onsite for disposal with other site materials. In this case the onsite containment structures should be evaluated for use as long term storage facilities. Other site conditions such as drainage control, security, soil type, etc. must be considered so that proper storage is provided. If onsite storage is anticipated, then it should be ascertained that the containment structures are designed for this purpose.

Photographs

Photographs or slides should be taken at every sampling location to verify the written description in the field logbook. Procedures and requirements are discussed in Section 5.

Chain-of-Custody

After collection and identification, the samples are maintained under the chain-of-custody described in Section 2 of this Volume and in Volume II, Appendix D.

SECTION 8

BIBLIOGRAPHY

Benson, Barrett. Procedures for Identifying Responsible Parties--Uncontrolled Hazardous Waste Sites--Superfund (Final Draft). U.S. Environmental Protection Agency, Office of Legal and Enforcement Council. February 1982.

U.S. Environmental Protection Agency. Available Field Methods for Rapid Screening of Hazardous Waste Materials at Waste Sites, Interim Report, Class A Poisons. EPA 600/X-82-014. December 1982.

U.S. Environmental Protection Agency. Guide for Preparation of a Remedial Action Master Plan (RAMP). Preliminary Draft. HQ-8201-01. March 1983.

U.S. Environmental Protection Agency. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans. QAMS-005/80. December 29, 1980.

U.S. Environmental Protection Agency. User's Guide to the EPA Contract Laboratory Program. August 1982.

U.S. Environmental Protection Agency. Enforcement Considerations for Evaluations of Uncontrolled Hazardous Waste Disposal Sites by Contractors. April 1980.

U.S. Environmental Protection Agency. NEIC Policies and Procedures. EPA 330/9-78-001-R, May 1978, Revised December 1981.

U.S. Environmental Protection Agency. NEIC Procedures Manual for the Evidence Audit of Enforcement Investigations by Contractor Evidence Audit Teams. EPA-330/9-81-003, September 1981.

U.S. Environmental Protection Agency. Technical Methods for Investigating Sites Containing Hazardous Substances, Technical Monograph 1-29 (Draft). Prepared for OERR by Ecology and the Environment. June 1981.

U.S. Environmental Protection Agency. A Protocol for Field Characterization of Hazardous Waste (Draft). Prepared for Region VII by Ecology and Environment. March 1982.

SECTION 9

GLOSSARY

ACCURACY: The degree of agreement of a measurement with an accepted reference or true value. Accuracy is expressed as (1) the difference between the two values, (2) a percentage of the reference or true value, or (3) a ratio of the two values.

AUDIT: A systematic check to determine the quality of operation of some function or activity. Audits may be of two basic types: (1) performance audits in which quantitative or qualitative data are independently obtained for comparison with routinely obtained data in a measurement system, or (2) systems audits of a qualitative nature that consist of an onsite review of a laboratory's quality assurance system and physical facilities for sampling, calibration, and measurement.

BIAS: The difference between the mean measurement and the reference or true value. A measurement of systematic error.

CAA: Clean Air Act, 42 U.S.C. 7401 et seq., as amended.

CASE MANAGEMENT PLAN [DOJ][OWPE]: A document prepared by a negotiation/litigation team which outlines the program to be followed in a judicial action. As a minimum it establishes the goals, further needs for investigative or litigative support; incorporates the findings of fact, provides a schedule, and addresses a schedule.

CEAT: Contractor Evidence Audit Team

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act, PL 96-510, December 1980

CFR: Code of Federal Regulation

CLP: Contract Laboratory Program

COD: Chemical Oxygen Demand

COMMUNITY RELATIONS PLAN (CRP): A plan for addressing local citizens' and officials' concerns to a hazardous waste site and integrating community relation activities into technical responses at sites to help prevent disruptions and delays in response actions. Each CRP should include a description of the background, history and community concerns of the site, specific objectives of the community relations program, specific techniques to be used to achieve those objectives, workplan and schedule, and budget and designation of staff who will be accountable.

COMPARABILITY: A measure of the confidence with which one data set can be compared to another.

COMPLETENESS: A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal circumstances.

COMPLIANCE EVALUATION INSPECTIONS: Thorough reviews and inspections of hazardous waste handlers. They involve a site visit to review and evaluate conditions at the facility of the waste handler, and may involve an onsite review of records, such as the waste analysis plan, the owner/operator inspection schedule and log, the groundwater monitoring plan, closure plans, and the contingency plans and emergency procedures. An evaluation inspection does not involve sampling.

COMPLIANCE SAMPLING INSPECTIONS: Sampling efforts conducted independently of compliance evaluation inspections, or concurrently with these inspections. In general, samples might be taken of ground and surface water, waste types and soil to determine the extent of contamination. These inspections may be triggered by compliance evaluation inspections, record reviews or citizen complaints that identify possible problems.

CONCEPTUAL DESIGN/REMEDIAL DESIGN [OERR][OWPE]: An assignment process which results in engineering plans, a schedule of implementation, materials, requirements, design criteria, budget estimate to include operation and maintenance safety plan for construction.

CWA: Clean Water Act, PL 92-500 as amended

DCO: Document Control Officer

DOJ: Deparment of Justice

DOT: Department of Transportation

DPO: Deputy Project Officer

EP: Extraction Procedure Toxicity Method: 40 CFR App. II, Apr. 8, 1983

EPA LEAD: The EPA has primary responsibilty for planning and conducting either part of or an entire removal or remedial action.

EPIC: Environmental Photographic Interpretation Center

EMSL: Environmental Monitoring Systems Laboratory

ENDANGERMENT ASSESSMENT [OWPE]: A report prepared as ordered by enforcement personnel to summarize, either qualitatively or quantitatively, a specific set of 6 factors in order to support a negotiation, administrative order or civil litigation. It can cause an IRM to be ordered. For NPL sites it is a product of the RI/FS modified for enforcement.

ENFORCEMENT RECORD OF DECISION (EROD) [OWPE]: A decision made by the Assistant Administrator of OSWER wherein the final remedy, or remedies, are chosen for presentation to the defendant.

EOD: Explosive Ordinance Disposal

ERRIS: Emergency and Remedial Response Information System: ERRIS is an automated inventory of all uncontrolled hazardous substance sites in the United States which are known to EPA. It contains data on the names and locations of these sites, summary response and enforcement event status information, alias names and locations, comments and optional regional event and site characteristic data.

ERT: Environmental Response Team

FEASIBILITY STUDY [OERR]: A report evaluating alternative remedial technologies and alternatives on the basis of risk to public health, technology, cost, environmental concerns and institutional requirements in order to identify the cost-effective action.

FEASIBILITY STUDY MODIFIED FOR ENFORCEMENT [OWPE]: See FEASIBILITY STUDY. This modification for OWPE use, includes everything that the OERR FS contains except it does not address Section 300.68(K) of the NCP (fund balancing).

FDR: Field Data Records

FIFRA: Federal Insecticide, Fungicide and Rodenticide Act, PL 92-516 as amended

FINANCIAL ASSESSMENT [OWPE]: A series of searches and inputs which indicate the net financial worth of a defendant(s). Corporate records, NEIC and other sources are used to compile the data.

FIT: Field Investigation Team

FOLLOWUP: An inspection or other activity intended to verify compliance with an enforcement action. A followup action may also be a reinspection to review deficiencies noted in a previous inspection.

FR: Federal Register

HAZARD RANKING SYSTEM (HRS) [OERR]: A model developed and designed to provide an estimate of the relative severity of a hazardous substance site. The HRS computes a score for each candidate site from 1 to 100, which serves as an input to the decision of whether the site should be included on the National Priority List and if so, at what ranking compared to other sites contained on the list.

HAZARDOUS SUBSTANCE: Also sometimes referred to as hazardous waste, means (a) any substance designated pursuant to Section 311(b)(2)(A) of the Federal Water Pollution Control Act, (b) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of this Act, (c) any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress, (d) any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act, (e) any hazardous air pollutant listed under Section 112 of the Clean Air Act, and (f) any imminently hazardous chemical substance or mixture with respect to which the Administrator [EPA] has taken action pursuant to Section 7 of the Toxic Substance Control Act. The term does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under Subparagraphs (a) through (f) of this paragraph, and the term does not include natural gas, natural gas liquids, liquified natural gas or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas).

HWS: Hazardous Waste Site

IDLH: Immediately Dangerous to Life and Health

IMPLEMENTATION OF REMEDY [OERR][OWPE]: The process of carrying out the selected remedial option.

INITIAL REMEDIAL MEASURE (IRM): A class of actions that may be undertaken during a remedial response to limit exposure or threat of exposure to a significant health or environmental hazard or to stabilize an existing situation at a site in order to permit the implementation of additional actions. Examples of factors used determining if initial remedial measures are appropriate and the associated action which may be taken include:

- Actual or potential direct contact with hazardous substances (measures might include fences, site security).
- Substantial threat of fire or explosion or of a serious public health hazard (measures might include drum removal).
- Highly contaminated soils largely at or near suface (measures might include temporary capping or removal of highly contaminated soils from drainage areas).

An intial remedial measure is categorized as a "project" in the Project Tracking System (PTS) data element hierachy.

NATIONAL CONTINGENCY PLAN (NCP): Officially known as the National Oil and Hazardous Substances Pollution Contingency Plan, outlines the responsibilities and authorities for responding to releases into the environment of hazardous substances and other pollutants and contaminants under the statutory authority of CERCLA and section 311 of the Clean Water Act (CWA).

NATIONAL PRIORITY LIST (NPL): A list of at least 400 of the highest priority releases or potential releases of hazardous substances, based upon State and EPA Regional submissions of candidate sites and the criteria and methodology contained in the Hazard Ranking System (HRS), in order to allocate funds for remedial and planned removal actions.

NEIC: National Enforcement Investigations Center

NPDES: National Pollutant Discharge Elimination System

OERR: Office of Emergency and Remedial Response

OIC: Officer in Charge

ORD: Office of Research and Development

OVA: Organic Vapor Analyzer

OWPE: Office of Waste Programs Enforcement

PDS: Personnel Decontamination Station

PL: Public Law

POST-CLOSURE MONITORING [OERR][OWPE]: All activity after the cleanup to assure that a threat no longer exists.

PRECISION: The degree of agreement between repeated measurements of one property using the same method or technique. A measurement of the random error.

PRELIMINARY ASSESSMENT [OERR]: A process of collecting and reviewing readily available information about a known or suspected hazardous waste site, or release, used to make a first effort to determine the magnitude of hazard, source, nature of release and identity of responsible party. No field work required.

PRELIMINARY INVESTIGATION [OWPE]: A very short-term field study used to define a problem at a non-National Priority List site. It involves the collecting of field data sufficient to compile a document similar to the Endangerment Assessment for a National Priority List site or to support the Enforcement Planning Effort.

PRIORITY SITE: A site that has been included on either the Interim Priority List or National Priority List.

PROJECT TRACKING SYSTEM (PTS): The automated system developed by EPA to track and provide information for oversight of remedial responses on the Interim or National Priority List. The system includes a four-level data element hierarchy consisting of: (1) "site" - one of the Interim or National

Priority List sites; (2) "project" - initial remedial measure or remedial action; (3) "activity"-remedial investigation, feasibility study, remedial design, or remedial construction; and (4) "task"- e.g., fence construction, slurry wall design, etc.

QAO: Quality Assurance Officer

QA/QC: Quality Control/Quality Assurance

QUALITY ASSURANCE: The total integrated program for assuring the reliability of monitoring and measurement data.

QUALITY ASSURANCE PROGRAM PLAN: An orderly assembly of management policies, objectives, principles, and general procedures by which an agency or laboratory outlines how it intends to produce quality data.

QUALITY CONTROL: The routine application of procedures for obtaining prescribed standards of performance in the monitoring and measurement process.

RCRA: The Resource Conservation and Recovery Act, PL 94-590, October 1976

RECORD OF DECISION (ROD)[OERR]: A decision process wherein a final solution for the remedy of an NPL site, handled by OERR, is chosen from a group of options.

RECORD REVIEW: An examination of records and reports, independent of an inspection. It may occur either at the waste handler's office or at the State or Regional offices. The examination may involve a review of reports submitted by the handler, such as financial documents and groundwater monitoring reports. It may also involve review of records kept by the handler, such as tests and analyses performed by the facility, the facility's self-monitoring records, manifests, closure and post-closure plans, and contingency plans.

REMEDIAL INVESTIGATION (RI)[OERR]: A field investigation ordered by OERR to gather the data necessary to (1) determine the nature and extent of a problem at a site, (2) establish clean-up criteria, (3) identify preliminary remedial alternatives, and (4) support the technical and cost analyses of the alternatives. The activities are structured and generally not totally satisfactory for enforcement purposes.

REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) MODIFIED FOR ENFORCEMENT (OWPE): Designed by enforcement personnel, which in addition to the OERR RI confirms a source or capability, more fully defines the physical characteristics of a site, and further defines the threat. One product of the Investigation is the Endangerment Assessment.

REPRESENTATIVENESS: The degree to which data accurately and precisely represent a characteristic of a population, the variation of a parameter at a sampling point, or an environmental condition.

RESPONSIBLE PARTY: As defined by Section 107(a) of CERCLA includes "(1) the owner or operator of a vessel (otherwise subject to the jurisdiction of the United States) or a facility, (2) any person who at the time of disposal of any hazardous substance owned or operated any facility at which such hazardous substances were disposed of, (3) any person who by contract, agreement, or otherwise arranged for disposal or treatment, or arranged with a transporter for transport for disposal or treatment, of hazardous substances owned or possessed by such person, by any other party or entity, at any facility owned or operated by another party or entity and containing such hazardous substances, and (4) any person who accepts or accepted any hazardous substances for fee transport to or treatment facilities or sites selected by such person, from which there is a release, or a threatened release which causes the incurrence of response costs, of a hazardous substance, shall be liable for--(A) all costs of removal or remedial action incurred by the United States Government or a State not inconsistent with the National Contingency Plan; (B) any other necessary costs of response incurred by any other person consistent with the National Contingency Plan; and (C) damages for injury to, distraction of natural resources, including the reasonable costs of assessing such injury, destruction, or loss resulting from such a release."

RESPONSIBLE-PARTY SEARCH [OWPE]: An investigation conducted to trace the past and present owners of a site and other parties involved with the operation of the site. More detailed than the search done under a PA (Preliminary Assessment).

SCOPING: An assessment of the type of problem presented by a release and an initial determination of the type or types of remedial action that may be appropriate to remedy the problem. There are three classes of remedial actions: initial remedial measures, source control remedial action, and offsite control remedial action. Scoping is undertaken during the planning phase of a remedial action.

SDWA: Safe Drinking Water Act, PL 95-523

SCBA: Self-contained Breathing Apparatus

SITE: Also refers to a hazardous substance site or a hazardous waste site, is an area of land (or conceivably, water) or a location at which hazardous substances were stored, treated, disposed of, or placed, or otherwise came to be located. This includes all contiguous land, structures, other appurtenances, and improvements on the land, used for treating, storing, or disposing of hazardous substances. A site may consist of several treatment, storage, or disposal facilities (e.g., impoundments, containers, buildings, or equipment). "Site" is also the highest level of the 4 levels specified in the PTS data element hierarchy.

SITE INSPECTION [OERR]: A field study involving the collection of sufficient data to characterize the magnitude and severity of the hazard posed by a site in order to score the site for the HRS. It may include sampling, monitoring, land surveys, testing and other information-gathering activities.

SPECIAL INSPECTIONS: Inspections conducted where serious violations are suspected. They may be triggered by citizen complaints or indications of violations detected in other inspections. Inspector or inspectors may spend a number of days sampling or reviewing the operation of the facility.

STANDARD OPERATING PROCEDURE: An operation, analysis, or action whose mechanics are thoroughly prescribed and documented and which is commonly accepted as the usual or normal method for performing certain routine or repetitive tasks.

STATE LEAD: Means that a State has primary responsibility for planning and conducting either part of or an entire removal or remedial action.

STATEMENT OF WORK (SOW)[OERR]: An element of a work assignment (WA) package that specifies in detail the task and objectives to be performed by a contractor. It should include a background summary of the release, definition of the problem, purpose of work, and description of the services to be performed.

STUDY PLAN [OWPE]: A document, which presents the goals and specific activities to be undertaken in a Remedial Investigation modified for enforcement or an Enforcement Investigation. Contracted experts should help in the preparation of this plan.

STS: Site Tracking System. Has been replaced by ERRIS, Emergency and Remedial Response Information System.

SUMMARY INVESTIGATION [OWPE]: An enforcement process similar to the Preliminary Assessment which can incorporate previous studies by other agencies and indicate the adequacy of existing data. Can be performed near the beginning of an enforcement action when a non-National Priority List case is given to EPA by a state. It also may be conducted later if a site comes to enforcement from OERR. No field work required.

TASK [OERR][OWPE]: A discrete piece of work cited in a Statement of Work, Work Plan or Technical Duty Description.

TECHNICAL DUTY DESCRIPTION (TDD)[OERR][OWPE]: A set of discrete tasks given to the FIT contractor.

TLV: Threshold Limit Value: maximum 8-hour human exposure level.

TSCA: Toxic Substance Control Act, PL 94-469 as amended by PL 97-129

TSDF: Treatment, Storage and Disposal Facility

TOC: Total Organic Carbon

TOX: Total Organic Halogen

USGS: United States Geologic Survey

WORK ASSIGNMENT (WA)[OERR]: A document containing a Statement of Work which also includes an estimate of direct labor hours and required period of performance.

WORK PLAN (WP)[OERR][OWPE]: A contractors submittal of a written response to a WA defining the technical approach to a project, the budget and schedule. Other documents enclosed are the Health and Safety Plan and QA/QC plan.

APPENDIX A
EVIDENCE AUDIT CHECKLISTS

FIELD CHECKLIST

Briefing with Project Coordinator

PROJECT NO. ________________ DATE OF AUDIT ____________________

PROJECT COORDINATOR __________ SIGNATURE OF AUDITOR ______________

PROJECT LOCATION ____

TYPE OF INVESTIGATION (authority, agency) ______________________________________

Yes__ No__ N/A__ 1. Has a project coordinator been appointed?

Comments: ______________________________________

Yes__ No__ N/A__ 2. Was a project plan prepared? If yes, what items are addressed in the plan?

Comments: ______________________________________

Yes__ No__ N/A__ 3. Was a briefing held with project participants?

Comments: ______________________________________

Yes__ No__ N/A__ 4. Were additional instructions given to project participants (i.e., changes in project plan)?

Comments: ______________________________________

Yes__ No__ N/A __ 5. Is there a written list of sampling locations and descriptions?

Comments: ______________________________________

Yes__ No__ N/A__ **6. Is there a map of sampling locations?**

Comments:

Yes__ No__ N/A__ **7. Do the investigators follow a system of accountable documents?**
If yes, what documents are accountable?

Comments:

Yes__ No__ N/A__ **8. Is there a list of accountable field documents checked out to the project coordinator?**
If yes, who checked them out?

Comments:

Yes__ No__ N/A__ **9. Is the transfer of field documents (sample tags, chain-of-custody records, logbooks, etc.) from the project coordinator to the field participants documented in a logbook?**

Comments:

FIELD CHECKLIST

Field Observations

Yes__ No__ N/A__ 1. Was permission granted to enter and inspect the facility?

Comments:______________________________________

____

____

Yes__ No__ N/A__ 2. Is permission to enter the facility documented?

Comments:______________________________________

____

____

Yes__ No__ N/A__ 3. Were split samples offered to the facility? If yes, was the offer accepted or declined?

Comments:______________________________________

____

____

Yes__ No__ N/A__ 4. If the offer to split samples was accepted, were the split samples collected?

Comments:______________________________________

____

____

Yes__ No__ N/A__ 5. Is the offering of split samples recorded?

Comments:______________________________________

____

____

Yes__ No__ N/A__ 6. If split samples are collected, are they documented? If yes, where are they documented?

Comments:______________________________________

____

____

Yes__ No__ N/A__ 7. Are the number, frequency, and types of field measurements and observations taken as specified in the project plan or as directed by the project coordinator?

Comments:______________________________________

____

____

Yes__ No__ N/A__ 8. Are field measurements recorded (pH, temperature, conductivity, etc.)? Where?

Comments:______________________________________

____

____

Yes__ No__ N/A__ 9. Are samples collected in the types of containers specified in the project plan or as directed by the project coordinator?

Comments:______________________________________

____

____

Yes__ No__ N/A__ 10. Are samples preserved as specified in the project plan or as directed by the project coordinator?

Comments:______________________________________

____

____

Yes__ No__ N/A__ 11. Are the number, frequency, and types of samples collected as specified in the project plan or as directed by the project coordinator?

Comments:______________________________________

____

____

Yes__ No__ N/A__ 12. Are samples packed for preservation as per the sample plan (i.e., packed in ice, etc.)?

Comments:______________________________________

____

____

Yes__ No__ N/A__ 13. Is sample custody maintained at all times?

Comments:______________________________________

FIELD CHECKLIST

Document Control

Yes__ No__ N/A__ 1. Have all unused and voided accountable documents been returned to the coordinator by the team members?

Comments:____

____

____

Yes__ No__ N/A__ 2. Have document numbers of all lost or destroyed accountable documents been recorded in the project coordinator's logbook?

Comments:____

____

____

Yes__ No__ N/A__ 3. Are all samples identified with sample tags?

Comments:____

____

____

Yes__ No__ N/A__ 4. Are all sample tags completed (e.g., station no., location, date, time, analyses, signatures of samplers, type, preservatives, etc.)?

Comments:____

____

____

Yes__ No__ N/A__ 5. Are all samples collected listed on a chain-of-custody record?
If yes, describe the type of chain-of-custody record used.

Comments:____

____

____

Yes__ No__ N/A__ 6. Are the sample tag numbers recorded on the chain-of-custody documents?

Comments:____________________

Yes__ No__ N/A__ 7. Does information on sample tags and chain-of-custody records match?

Comments:____________________

Yes__ No__ N/A__ 8. Does the chain-of-custody record indicate the method of sample shipment?

Comments:____________________

Yes __ No__ N/A__ 9. Is the chain-of-custody record included with the samples in the shipping container?

Comments:____________________

Yes__ No__ N/A__ 10. Do the sample traffic reports agree with the sample tags?

Comments:____________________

Yes__ No__ N/A__ 11. If required, has a receipt for samples been provided to the facility?

Comments:____________________

Yes__ No__ N/A__ 12. If required, was the offer of a receipt for samples documented?

Comments:____________________

Yes__ No__ N/A__ 13. If used, are blank samples identified?

Comments:____

____

____

Yes__ No__ N/A__ 14. If collected, are duplicate samples identified on sample tags and chain-of-custody records?

Comments:____

____

____

Yes__ No__ N/A__ 15. If used, are spiked samples identified?

Comments:____

____

____

Yes__ No__ N/A__ 16. Are logbooks signed by the individual who checked out the logbook from the project coordinator?

Comments:____

____

____

Yes__ No__ N/A__ 17. Are logbooks dated upon receipt from the project coordinator?

Comments:____

____

____

Yes__ No__ N/A__ 18. Are logbooks project-specific (by logbook or by page)?

Comments:____

____

____

Yes__ No__ N/A__ 19. Are logbook entries dated and identified by author?

Comments:____

____

____

Yes__ No__ N/A__ 20. Is the facility's approval or disapproval to take photographs noted in a logbook?

Comments:____

____

____

Yes__ No__ N/A__ 21. Are photographs documented in logbooks (e.g., time, date, description of subject, photographer, etc.)?

Comments:____

____

____

Yes__ No__ N/A__ 22. If a Polaroid camera is used, are photos matched with logbook documentation?

Comments:____

____

____

Yes__ No__ N/A__ 23. Are sample tag numbers recorded in the project coordinator's logbook?

Comments:____

____

____

Yes__ No__ N/A__ 24. Are Quality Control checks documented (i.e., calibration of pH meters, conductivity meters, etc.)?

Comments:____

____

____

Yes__ No__ N/A__ 25. Are amendments to the project plan documented (on the project plan itself, in a project logbook, elsewhere)?

Comments:____

____

____

FIELD CHECKLIST

Debriefing with Project Coordinator

Yes__ No__ N/A__ 1. Was a debriefing held with project participants after the audit was completed?

Comments:______________________________________

Yes__ No__ N/A__ 2. Were any recommendations made to project participants during the debriefing? If yes, briefly describe what recommendations were made.

Comments:______________________________________

DOCUMENT AUDIT CHECKLIST

PROJECT NO. ____________________ DATE OF AUDIT ____________________

PROJECT LOCATION ______________ SIGNATURE OF AUDITOR ____________

FILE LOCATION __________________

Yes__ No__ 1. Have individual files been assembled (field investigation, laboratory, other)?

Comments: ______________________________

Yes__ No__ 2. Is each file inventoried?

Comments: ______________________________

Yes__ No__ 3. Is there a list of accountable documents?

Comments: ______________________________

Yes__ No__ 4. Are all accountable documents present or accounted for?

Comments: ______________________________

Yes__ No__ 5. Is a document numbering system used?

Comments: ______________________________

Yes__ No__ 6. Has each document been assigned a document control number?

Comments:______________________________

____

____

Yes__ No__ 7. Are all documents listed on the inventory accounted for?

Comments:______________________________

____

____

Yes__ No__ 8. Are there any documents in the file which are not on the inventory?

Comments:______________________________

____

____

Yes__ No__ 9. Is the file stored in a secure area?

Comments:______________________________

____

____

Yes__ No__ 10. Are there any project documents which have been declared confidential?

Comments:______________________________

____

____

Yes__ No__ 11. Are confidential documents stored in a secure area separate from other project documents?

Comments:______________________________

____

____

Yes__ No__ 12. Is access to confidential files restricted?

Comments:______________________________

____

____

Yes__ No__ 13. Have confidential documents been marked or stamped "Confidential"?

Comments:______________________________

____

____

Yes__ No__ 14. Is confidential information inventoried?

Comments:______________________________

____

____

Yes__ No__ 15. Is confidential information numbered for document control?

Comments:______________________________

____

____

Yes__ No__ 16. Have any documents been claimed confidential under TSCA?

Comments:______________________________

____

____

APPENDIX B

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT FORM

United States
Environmental Protection
Agency

Office of Emergency and
Remedial Response
Washington, DC 20460

EPA Form 2070-12
July, 1981

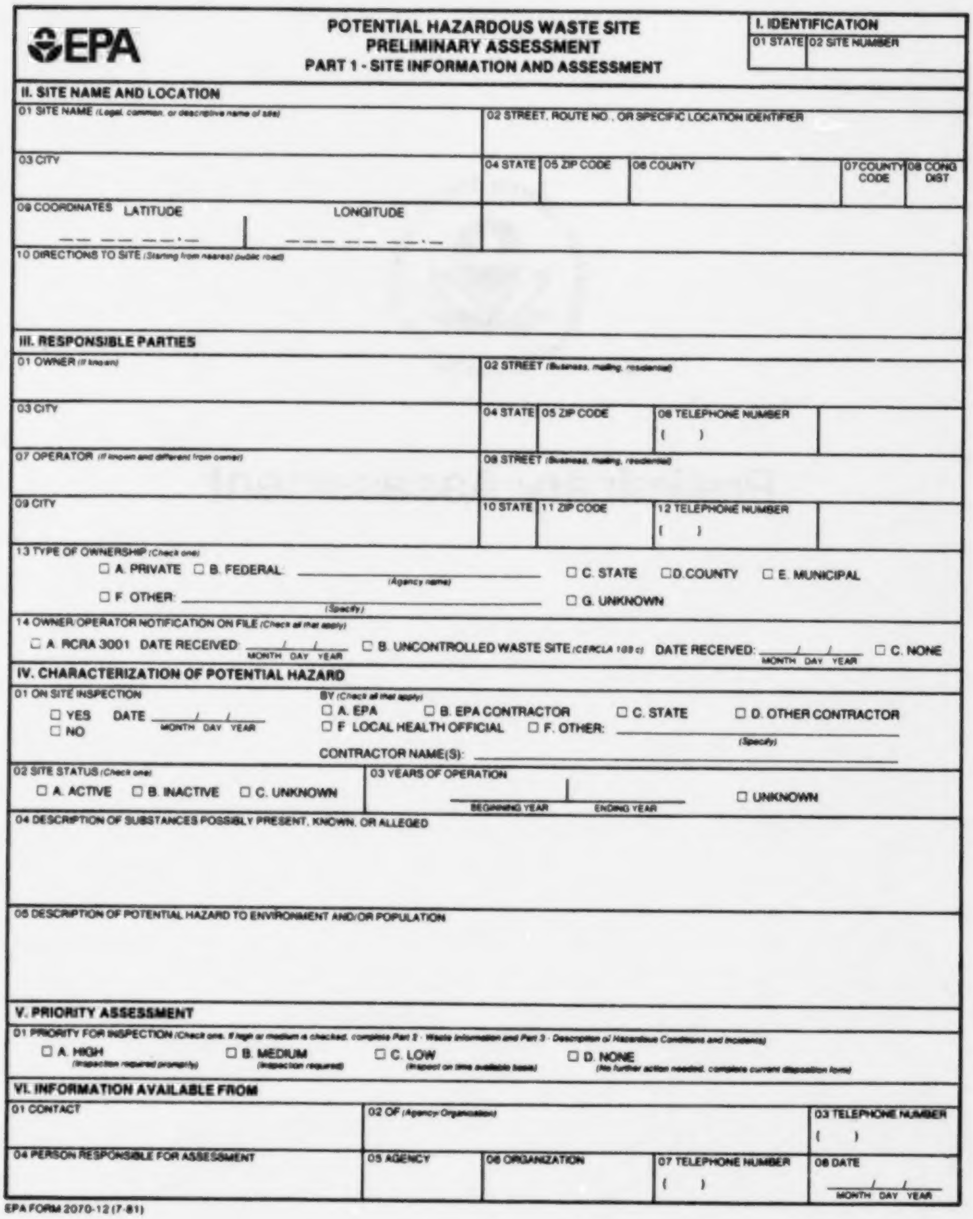
EPA

Potential Hazardous Waste Site

Preliminary Assessment

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Preliminary Assessment



EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 1 - SITE INFORMATION AND ASSESSMENT

I. IDENTIFICATION
01 STATE
02 SITE NUMBER

II. SITE NAME AND LOCATION
01 SITE NAME *(Legal, common, or descriptive name of site)*
02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER
03 CITY
04 STATE
05 ZIP CODE
06 COUNTY
07 COUNTY CODE
08 CONG DIST
09 COORDINATES LATITUDE __ __ __ __ . __ LONGITUDE ___ __ __ . __
10 DIRECTIONS TO SITE *(Starting from nearest public road)*

III. RESPONSIBLE PARTIES
01 OWNER *(If known)*
02 STREET *(Business, mailing, residential)*
03 CITY
04 STATE
05 ZIP CODE
06 TELEPHONE NUMBER ( )
07 OPERATOR *(If known and different from owner)*
08 STREET *(Business, mailing, residential)*
09 CITY
10 STATE
11 ZIP CODE
12 TELEPHONE NUMBER ( )
13 TYPE OF OWNERSHIP *(Check one)*
☐ A. PRIVATE ☐ B. FEDERAL: ____________ *(Agency name)* ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL
☐ F. OTHER: ____________ *(Specify)* ☐ G. UNKNOWN
14 OWNER/OPERATOR NOTIFICATION ON FILE *(Check all that apply)*
☐ A. RCRA 3001 DATE RECEIVED: __/__/__ MONTH DAY YEAR ☐ B. UNCONTROLLED WASTE SITE *(CERCLA 103 c)* DATE RECEIVED: __/__/__ MONTH DAY YEAR ☐ C. NONE

IV. CHARACTERIZATION OF POTENTIAL HAZARD
01 ON SITE INSPECTION
☐ YES DATE __/__/__ MONTH DAY YEAR
☐ NO
BY *(Check all that apply)*
☐ A. EPA ☐ B. EPA CONTRACTOR ☐ C. STATE ☐ D. OTHER CONTRACTOR
☐ F LOCAL HEALTH OFFICIAL ☐ F. OTHER: ____________ *(Specify)*
CONTRACTOR NAME(S): ____________
02 SITE STATUS *(Check one)*
☐ A. ACTIVE ☐ B. INACTIVE ☐ C. UNKNOWN
03 YEARS OF OPERATION
______ | ______ BEGINNING YEAR ENDING YEAR ☐ UNKNOWN
04 DESCRIPTION OF SUBSTANCES POSSIBLY PRESENT, KNOWN, OR ALLEGED
05 DESCRIPTION OF POTENTIAL HAZARD TO ENVIRONMENT AND/OR POPULATION

V. PRIORITY ASSESSMENT
01 PRIORITY FOR INSPECTION *(Check one. If high or medium is checked, complete Part 2 - Waste Information and Part 3 - Description of Hazardous Conditions and Incidents)*
☐ A. HIGH *(Inspection required promptly)*
☐ B. MEDIUM *(Inspection required)*
☐ C. LOW *(Inspect on time available basis)*
☐ D. NONE *(No further action needed, complete current disposition form)*

VI. INFORMATION AVAILABLE FROM
01 CONTACT
02 OF *(Agency/Organization)*
03 TELEPHONE NUMBER ( )
04 PERSON RESPONSIBLE FOR ASSESSMENT
05 AGENCY
06 ORGANIZATION
07 TELEPHONE NUMBER ( )
08 DATE __/__/__ MONTH DAY YEAR

EPA FORM 2070-12 (7-81)

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POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES *(Check all that apply)*

☐ A SOLID
☐ B POWDER, FINES
☐ C SLUDGE
☐ D OTHER ______________ *(Specify)*
☐ E SLURRY
☐ F LIQUID
☐ G GAS

02 WASTE QUANTITY AT SITE *(Measures of waste quantities must be independent)*

TONS ______________
CUBIC YARDS ______________
NO. OF DRUMS ______________

03 WASTE CHARACTERISTICS *(Check all that apply)*

☐ A TOXIC
☐ B CORROSIVE
☐ C RADIOACTIVE
☐ D PERSISTENT
☐ E SOLUBLE
☐ F INFECTIOUS
☐ G FLAMMABLE
☐ H IGNITABLE
☐ I HIGHLY VOLATILE
☐ J EXPLOSIVE
☐ K REACTIVE
☐ L INCOMPATIBLE
☐ M NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS			
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

IV. HAZARDOUS SUBSTANCES *(See Appendix for most frequently cited CAS Numbers)*

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION

V. FEEDSTOCKS *(See Appendix for CAS Numbers)*

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analysis, reports)*

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POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☐ A. GROUNDWATER CONTAMINATION
02 ☐ OBSERVED (DATE: ____________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____________
04 NARRATIVE DESCRIPTION

01 ☐ B. SURFACE WATER CONTAMINATION
02 ☐ OBSERVED (DATE: ____________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____________
04 NARRATIVE DESCRIPTION

01 ☐ C. CONTAMINATION OF AIR
02 ☐ OBSERVED (DATE: ____________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____________
04 NARRATIVE DESCRIPTION

01 ☐ D. FIRE/EXPLOSIVE CONDITIONS
02 ☐ OBSERVED (DATE: ____________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____________
04 NARRATIVE DESCRIPTION

01 ☐ E. DIRECT CONTACT
02 ☐ OBSERVED (DATE: ____________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____________
04 NARRATIVE DESCRIPTION

01 ☐ F. CONTAMINATION OF SOIL
02 ☐ OBSERVED (DATE: ____________) ☐ POTENTIAL ☐ ALLEGED
03 AREA POTENTIALLY AFFECTED: ____________ (Acres)
04 NARRATIVE DESCRIPTION

01 ☐ G. DRINKING WATER CONTAMINATION
02 ☐ OBSERVED (DATE: ____________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____________
04 NARRATIVE DESCRIPTION

01 ☐ H. WORKER EXPOSURE/INJURY
02 ☐ OBSERVED (DATE: ____________) ☐ POTENTIAL ☐ ALLEGED
03 WORKERS POTENTIALLY AFFECTED: ____________
04 NARRATIVE DESCRIPTION

01 ☐ I. POPULATION EXPOSURE/INJURY
02 ☐ OBSERVED (DATE: ____________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____________
04 NARRATIVE DESCRIPTION

EPA FORM 2070-12 (7-81)

EPA	POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS	I. IDENTIFICATION 01 STATE 02 SITE NUMBER

II. HAZARDOUS CONDITIONS AND INCIDENTS *(Continued)*

01 ☐ J. DAMAGE TO FLORA 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ K. DAMAGE TO FAUNA 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION *(Include name(s) of species)*

01 ☐ L. CONTAMINATION OF FOOD CHAIN 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ M. UNSTABLE CONTAINMENT OF WASTES 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
(Spills/runoff/standing liquids/leaking drums)
03 POPULATION POTENTIALLY AFFECTED: ______ 04 NARRATIVE DESCRIPTION

01 ☐ N. DAMAGE TO OFFSITE PROPERTY 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ P. ILLEGAL/UNAUTHORIZED DUMPING 02 ☐ OBSERVED (DATE: ______) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS

III. TOTAL POPULATION POTENTIALLY AFFECTED: ______

IV. COMMENTS

V. SOURCES OF INFORMATION *(Cite specific references, e. g., state files, sample analysis, reports)*

EPA FORM 2070-12 (7-81)

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT

General Information

The Potential Hazardous Waste Site, Preliminary Assessment form is used to record information necessary to make an initial evaluation of the potential risk posed by a site and to recommend further action.

The Preliminary Assessment form contains three parts:

Part 1 – Site Information and Assessment

Part 2 – Waste Information

Part 3 – Description of Hazardous Conditions and Incidents

Part 1 – Site Information and Assessment contains all of the data elements also contained on the Site Identification form required to add a site to the automated Site Tracking System (STS). It is therefore possible to add a site to STS at the Preliminary Assessment stage. Instructions are given below.

Part 2 – Waste Information and Part 3 – Description of Hazardous Conditions and Incidents are used to record specific information about substances, amounts, hazards, and targets, e.g., population potentially affected, that are used in determining the priority for further action. Parts 2 and 3 are also contained in the Potential Hazardous Waste Site, Site Inspection Report form where they may be used to update, add, delete, or correct information supplied on the Preliminary Assessment.

An Appendix with feedstock names and CAS Numbers and the most frequently cited hazardous substances and CAS Numbers is located behind the instructions for the Preliminary Assessment.

General Instructions

1. Complete the Preliminary Assessment form as completely as possible.

2. Starred items (*) are required before assessment information can be added to STS. The system will not accept incomplete assessment information.

3. To add a site to STS at the Preliminary Assessment stage, write "New" across the top of the form and complete items II-01, 02, 03, 04, and 06, Site Name and Location, and item III-13, Type of Ownership.

4. Data items carried in STS, which are identical to those on the Site Identification form and which can be added, deleted, or changed using the Preliminary Assessment form, are indicated with a pound sign (#). To ensure that the proper action is taken, outline the item(s) to be added, deleted, or changed with a bright color and indicate the proper action with "A" (add), "D" (delete), or "C" (change).

5. There are two options available for adding, deleting, or changing information supplied on the Preliminary Assessment form. The first is to use a new Preliminary Assessment form, completing only those items to be added, deleted, or changed. Mark the form clearly, using "A", "D", or "C", to indicate the action to be taken. If only data carried in STS are to be altered, the Site Source Data Report may be used. Using the report, mark clearly the items to be changed and the action to be taken.

Detailed Instructions

Part 1 Site Information and Assessment

I. **Identification**: Identification (State and Site Number) is the site record key, or primary identifier, for the site. Site records in the STS are updated based on Identification. It is essential that State and Site Number are correctly entered on each form.

*I-01 State: Enter the two character alpha FIPS code for the state in which the site is located. It must be identical to State on the Site Identification form.

*I-02 Site Number: Enter the ten character alphanumeric code for sites which have a Dun and Bradstreet or EPA "user" Dun and Bradstreet number or the ten character numeric GSA identification code for federal sites. The Site Number must be identical to the Site Number on the Site Identification form.

II. **Site Name and Location**: If Site Name and Location information require no additions or changes, these items are not required on the Preliminary Assessment form. However, completing these items will facilitate use of the completed form and records management procedures.

#II-01 Site Name: Enter the legal, common, or descriptive name of the site.

#II-02 Site Street: Enter the street address and number (if appropriate) where the site is located. If the precise street address is unavailable for this site, enter brief direction identifier, e.g., NW intersection I-295 & US 99; Post Rd, 5 mi W of Rt. 5.

#II-03 Site City: Enter the city, town, village, or other municipality in which the site is located. If the site is not located in a municipality, enter the name of the municipality (or place) which is nearest the site or which most easily locates the site.

#II-04 Site State: Enter the two character alpha FIPS code for the state in which the site is located. The code must be the same as in item I-01.

#II-05 Site Zip Code: Enter the five character numeric zip code for the postal zone in which the site is located.

#II-06 Site County: Enter the name of the county, parish (Louisiana), or borough (Alaska) in which the site is located.

#II-07 County Code: Enter the three character numeric FIPS county code for the county, parish, or borough in which the site is located. (The regional data analyst will furnish this data item.)

#II-08 Site Congressional District: Enter the two character number for the congressional district in which the site is located.

II-09 Coordinates: Enter the Coordinates, Latitude and Longitude, of the site in degrees, minutes, seconds and tenths of seconds. If a tenth of a second is insignificant at this site, enter "0"

II-10 Directions to Site: Starting from the nearest public road, provide narrative directions to the site.

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III. Responsible Parties

#III-01 Site Owner: Enter the name of the owner of the site. The site owner is the person, company, or federal, state, municipal or other public or private entity, who currently holds title to the property on which the site is located.

#III-02 -03 -04 -05 Site Owner Address: Enter the current complete business, residential, or mailing address at which the owner of the site can be reached.

III-06 Site Owner Telephone Number: Enter the area code and local telephone number at which the owner of the site can be reached.

#III-07 Site Operator: If different from Site Owner, enter the name of the operator at the site. The site operator is the person, company, or federal, state, municipal or other public or private entity, who currently, or most recently, is, or was, responsible for operations at the site.

#III-08 -09 -10 -11 Site Operator Address: Enter the current complete business, residential, or mailing address at which the operator of the site can be reached.

III-12 Site Operator Telephone Number: Enter the area code and local telephone number at which the operator of the site can be reached.

#III-13 Type of Ownership: Check the appropriate box to indicate the type of site ownership. If the site is under the jurisdiction of an activity of the federal government, enter the name of the department, agency, or activity. If Other is indicated, specify the type of ownership and name.

III-14 Owner/Operator Notification On File: Check the appropriate box(es) to indicate that the notification required by RCRA (3001) and/or CERCLA (103c, Superfund) have been received. If received, enter the date(s) received. Check none if not received.

IV Characterization of Potential Hazard

IV-01 On Site Inspection: Check the appropriate box to indicate that the site has been inspected or visited by EPA, a state or local official, or a contractor representative of EPA or a state or local government. Enter the date of the inspection. Check the appropriate box(es) to indicate who visited the site or performed the inspection. If the site visit was performed by a contractor, enter the name of the company.

*IV-02 Site Status: Check the appropriate box(es) to indicate the current status of the site. Active sites are those which treat, store, or dispose of wastes. Check Active for those active sites with an inactive storage or disposal area. Inactive sites are those at which treatment, storage, or disposal activities no longer occur.

IV-03 Years of Operation: Enter the beginning and ending years (or beginning only if operations at the site are on-going), e.g., 1878/1932, of waste treatment, storage, and/or disposal activities at the site. Check Unknown if the years of operation are not known.

IV-04 Description of Substances Possibly Present, Known, or Alleged: Provide a narrative description of hazardous, potentially hazardous, or other substances present, or claimed to be present, at the site.

IV-05 Description of Potential Hazard to Environment and/or Population: Provide a narrative description of the potential hazard the site poses to the environment and to exposed population or wildlife. If no hazard, or potential hazard, exists, provide the basis for that determination.

V. Priority Assessment

*V-01 Priority for Inspection: Check the appropriate box to indicate the priority for further action or inspection. If no further action is required, complete the Potential Hazardous Waste Site, Current Disposition form. The Priority for Inspection assessed must be supported by appropriate data in Part 2 – Waste Information and Part 3 – Description of Hazardous Conditions and Incidents of this form. If no hazardous conditions exist, Part 3 is not required.

VI. Information Available From

VI-01 Contact: Enter the name of the individual who can provide information about the site.

VI-02 Of: If appropriate, enter the name of the Public or private agency, firm, or company and the organization within the agency, firm, or company of the individual named as Contact.

VI-03 Telephone Number: Enter the area code and local telephone number of the individual named as contact.

VI-04 Person Responsible for Assessment: Enter the name of the individual who made the site assessment and assigned the priority rating to the site. The person responsible for the assessment may be different from the individual who prepared the form.

VI-05 Agency: Enter the name of the Agency where the individual who made the assessment is employed.

VI-06 Organization: Enter the name of the organization within the Agency.

VI-07 Telephone Number: Enter the area code and local telephone number of the individual who made the assessment.

VI-08 Date: Enter the date the assessment was made.

Part 2 Waste Information

*I. **Identification**: Refer to Part 1–I.

II. **Waste States, Quantities, and Characteristics**: Waste States, Quantities, and Characteristics provide information about the physical structure and form of the waste, measures of gross amounts at the site, and the hazards posed by the waste, considering acute and chronic health effects and mobility along a pathway.

*II-01 Physical States: Check the appropriate box(es) to indicate the state(s) of waste present, or thought to be present, at the site. If Other is indicated, specify the physical state of the waste.

*II-02 Waste Quantity at Site: Enter estimates of amounts of waste at the site. Estimates may be in weight (Tons) or volume (Cubic Yards or Number of Drums). Use as many entries as are appropriate; however, measurements must be independent. For example, do not measure the same amounts of waste as both tons and cubic yards.

•II-03 Waste Characteristics: Check all appropriate entries to indicate the hazards posed by waste at the site. If waste at the site poses no hazard, check Not Applicable.

III. **Waste Category**: General categories of waste typically found are listed here. Enter the estimated gross amount of the category of waste next to the appropriate substance name and enter the unit of measure used with the estimate.

•III-01 Gross Amount: Gross Amount is the estimate of the amount of the waste category found at the site. Estimates should be furnished in metric tons (MT), tons (TN), cubic meters (CM), cubic yards (CY), drums (DR), acres (AC), acre feet (AF), liters (LT), or gallons (GA). Enter the estimated amount next to the appropriate waste category.

•III-02 Unit of Measure: Enter the appropriate unit of measure: MT (metric tons),TN (tons), CM (cubic meters), CY (cubic yards), DR (number of drums), AC (acres), AF (acre feet), LT (liters), or GA (gallons), next to the estimate of gross amount.

III-03 Comments: Comments may be used to further explain, or provide additional information, about particular waste categories.

IV. **Hazardous Substances**: Specific hazardous, or potentially hazardous, chemicals, mixtures, and substances found at the site are listed here. This information may not be available at the Preliminary Assessment stage. Substances for which information is available are to be listed here. For each substance listed those data items marked with an "at" sign (@) must be included.

@IV-01 Category: Enter in front of the substance name the three character waste category from Section III which best describes the substance, e.g., OLW (Oily Waste).

@IV-02 Substance Name: Enter one of the following: the name of the substance registered with the Chemical Abstract Service, the common or accepted abbreviation of the substance, the generic name of the substance, or commercial name of the substance.

@IV-03 CAS Number: Enter the number assigned to the substance when it was registered with the Chemical Abstract Service. Refer to the Appendix for most frequently cited CAS Numbers. CAS Numbers must be furnished for each substance listed. If a CAS Number for this substance has not been assigned, enter "999".

@IV-04 Storage/Disposal Method: Enter the type of storage or disposal facility in which the substance was found: SI (surface impoundment, including pits, ponds, and lagoons), PL (pile), DR (drum), TK (tank), LF (landfill), LM (landfarm), OD (open dump).

IV-05 Concentration: Enter the concentration of the substance found in samples taken at the site.

IV-06 Measure of Concentration: Enter the appropriate unit of measure for the measured concentration of the substance found in the sample, e.g., MG/L, UG/L.

V. **Feedstocks**

V-01 Feedstock Name: If feedstocks, or substances derived from one or more feedstocks, are present at the site, enter the name of each feedstock found. See the Appendix for the feedstock list.

V-02 CAS Number: Enter the CAS Number for each feedstock named. See the Appendix for feedstock CAS Numbers.

VI. **Sources of Information**: List the sources used to obtain information for this form. Sources cited may include: sample analysis, reports, inspections, official records, or other documentation. Sources cited provide the basis for information entered on the form and may be used to obtain further information about the site.

Part 3 Description of Hazardous Conditions and Incidents

•I. **Identification**: Refer to Part 1—I.

II. **Hazardous Conditions and Incidents**:

II-01 Hazards: Indicate each hazardous, or potentially hazardous, condition known, or claimed, to exist at the site.

II-02 Observed, Potential, or Alleged: Check Observed and enter the date, or approximate date, of occurrence if a release of contaminants to the environment, or some other hazardous incident, is known to have occurred. In cases of a continuing release, e.g., groundwater contamination, enter the date, or approximate date, the condition first became apparent. If conditions exist for a potential release, check potential. Check Alleged for hazardous, or potentially hazardous, conditions claimed to exist at the site.

II-03 Population Potentially Affected: For each hazardous condition at the site, enter the number of people potentially affected. For Soil enter the number of acres potentially affected.

II-04 Narrative Description: Provide a narrative description, or explanation, of each condition. Include any additional information which further explains the condition.

II-05 Description of Any Other Known, Potential, or Alleged Hazards: Provide a narrative description of any other hazardous, or potentially hazardous, conditions at the site not covered above.

III. **Total Population Potentially Affected**: Enter the total number of people potentially affected by the existence of hazardous, or potentially hazardous, conditions at the site. Do not sum the numbers shown for each condition.

IV. **Comments**: Other information relevant to observed, potential, or alleged hazards may be entered here.

V. **Sources of Information**: List the sources used to obtain information for this form. Sources cited may include: sample analysis, reports, inspections, official records, or other documentation. Sources cited provide the basis for information entered on the form and may be used to obtain further information about the site.

APPENDIX

I. FEEDSTOCKS

CAS Number	Chemical Name
1. 7664-41-7	Ammonia
2. 7440-36-0	Antimony
3. 1309-64-4	Antimony Trioxide
4. 7440-38-2	Arsenic
5. 1327-53-3	Arsenic Trioxide
6. 21109-95-5	Barium Sulfide
7. 7726-95-6	Bromine
8. 106-99-0	Butadiene
9. 7440-43-9	Cadmium
10. 7782-50-5	Chlorine
11. 12737-27-8	Chromite
12. 7440-47-3	Chromium
13. 7440-48-4	Cobalt

CAS Number	Chemical Name
14. 1317-38-0	Cupric Oxide
15. 7758-98-7	Cupric Sulfate
16. 1317-39-1	Cuprous Oxide
17. 74-85-1	Ethylene
18. 7647-01-0	Hydrochloric Acid
19. 7664-39-3	Hydrogen Fluoride
20. 1335-25-7	Lead Oxide
21. 7439-97-6	Mercury
22. 74-82-8	Methane
23. 91-20-3	Napthalene
24. 7440-02-0	Nickel
25. 7697-37-2	Nitric Acid
26. 7723-14-0	Phosphorus

CAS Number	Chemical Name
27. 7778-50-9	Potassium Dichromate
28. 1310-58-3	Potassium Hydroxide
29. 115-07-1	Propylene
30. 10588-01-9	Sodium Dichromate
31. 1310-73-2	Sodium Hydroxide
32. 7646-78-8	Stannic Chloride
33. 7772-99-8	Stannous Chloride
34. 7664-93-9	Sulfuric Acid
35. 108-88-3	Toluene
36. 1330-20-7	Xylene
37. 7646-85-7	Zinc Chloride
38. 7733-02-0	Zinc Sulfate

II. HAZARDOUS SUBSTANCES

CAS Number	Chemical Name
1. 75-07-0	Acetaldehyde
2. 64-19-7	Acetic Acid
3. 108-24-7	Acetic Anhydride
4. 75-86-5	Acetone Cyanohydrin
5. 506-96-7	Acetyl Bromide
6. 75-36-5	Acetyl Chloride
7. 107-02-8	Acrolein
8. 107-13-1	Acrylonitrile
9. 124-04-9	Adipic Acid
10. 309-00-2	Aldrin
11. 10043-01-3	Aluminum Sulfate
12. 107-18-6	Allyl Alcohol
13. 107-05-1	Allyl Chloride
14. 7664-41-7	Ammonia
15. 631-61-8	Ammonium Acetate
16. 1863-63-4	Ammonium Benzoate
17. 1066-33-7	Ammonium Bicarbonate
18. 7789-09-5	Ammonium Bichromate
19. 1341-49-7	Ammonium Bifluoride
20. 10192-30-0	Ammonium Bisulfite
21. 1111-78-0	Ammonium Carbamate
22. 12125-02-9	Ammonium Chloride
23. 7788-98-9	Ammonium Chromate
24. 3012-65-5	Ammonium Citrate, Dibasic
25. 13826-83-0	Ammonium Fluoborate
26. 12125-01-8	Ammonium Fluoride
27. 1336-21-6	Ammonium Hydroxide
28. 6009-70-7	Ammonium Oxalate
29. 16919-19-0	Ammonium Silicofluoride
30. 7773-06-0	Ammonium Sulfamate
31. 12135-76-1	Ammonium Sulfide
32. 10196-04-0	Ammonium Sulfite
33. 14307-43-8	Ammonium Tartrate
34. 1762-95-4	Ammonium Thiocyanate
35. 7783-18-8	Ammonium Thiosulfate
36. 628-63-7	Amyl Acetate
37. 62-53-3	Aniline
38. 7647-18-9	Antimony Pentachloride
39. 7789-61-9	Antimony Tribromide
40. 10025-91-9	Antimony Trichloride
41. 7783-56-4	Antimony Trifluoride
42. 1309-64-4	Antimony Trioxide
43. 1303-32-8	Arsenic Disulfide
44. 1303-28-2	Arsenic Pentoxide
45. 7784-34-1	Arsenic Trichloride
46. 1327-53-3	Arsenic Trioxide

CAS Number	Chemical Name
47. 1303-33-9	Arsenic Trisulfide
48. 542-62-1	Barium Cyanide
49. 71-43-2	Benzene
50. 65-85-0	Benzoic Acid
51. 100-47-0	Benzonitrile
52. 98-88-4	Benzoyl Chloride
53. 100-44-7	Benzyl Chloride
54. 7440-41-7	Beryllium
55. 7787-47-5	Beryllium Chloride
56. 7787-49-7	Beryllium Fluoride
57. 13597-99-4	Beryllium Nitrate
58. 123-86-4	Butyl Acetate
59. 84-74-2	n-Butyl Phthalate
60. 109-73-9	Butylamine
61. 107-92-6	Butyric Acid
62. 543-90-8	Cadimium Acetate
63. 7789-42-6	Cadmium Bromide
64. 10108-64-2	Cadmium Chloride
65. 7778-44-1	Calcium Arsenate
66. 52740-16-6	Calcium Arsenite
67. 75-20-7	Calcium Carbide
68. 13765-19-0	Calcium Chromate
69. 592-01-8	Calcium Cyanide
70. 26264-06-2	Calcium Dodecylbenzene Sulfonate
71. 7778-54-3	Calcium Hypochlorite
72. 133-06-2	Captan
73. 63-25-2	Carbaryl
74. 1563-66-2	Carbofuran
75. 75-15-0	Carbon Disulfide
76. 56-23-5	Carbon Tetrachloride
77. 57-74-9	Chlordane
78. 7782-50-5	Chlorine
79. 108-90-7	Chlorobenzene
80. 67-66-3	Chloroform
81. 7790-94-5	Chlorosulfonic Acid
82. 2921-88-2	Chlorpyrifos
83. 1066-30-4	Chromic Acetate
84. 7738-94-5	Chromic Acid
85. 10101-53-8	Chromic Sulfate
86. 10049-05-5	Chromous Chloride
87. 544-18-3	Cobaltous Formate
88. 14017-41-5	Cobaltous Sulfamate
89. 56-72-4	Coumaphos
90. 1319-77-3	Cresol
91. 4170-30-3	Crotonaldehyde

CAS Number	Chemical Name
92. 142-71-2	Cupric Acetate
93. 12002-03-8	Cupric Acetoarsenite
94. 7447-39-4	Cupric Chloride
95. 3251-23-8	Cupric Nitrate
96. 5893-66-3	Cupric Oxalate
97. 7758-98-7	Cupric Sulfate
98. 10380-29-7	Cupric Sulfate Ammoniated
99. 815-82-7	Cupric Tartrate
100. 506-77-4	Cyanogen Chloride
101. 110-82-7	Cyclohexane
102. 94-75-7	2,4-D Acid
103. 94-11-1	2,4-D Esters
104. 50-29-3	DDT
105. 333-41-5	Diazinon
106. 1918-00-9	Dicamba
107. 1194-65-6	Dichlobenil
108. 117-80-6	Dichlone
109. 25321-22-6	Dichlorobenzene (all isomers)
110. 266-38-19-7	Dichloropropane (all isomers)
111. 26952-23-8	Dichloropropene (all isomers)
112. 8003-19-8	Dichloropropene-Dichloropropene Mixture
113. 75-99-0	2-2-Dichloropropionic Acid
114. 62-73-7	Dichlorvos
115. 60-57-1	Dieldrin
116. 109-89-7	Diethylamine
117. 124-40-3	Dimethylamine
118. 25154-54-5	Dinitrobenzene (all isomers)
119. 51-28-5	Dinitrophenol
120. 25321-14-6	Dinitrotoluene (all isomers)
121. 85-00-7	Diquat
122. 298-04-4	Disulfoton
123. 330-54-1	Diuron
124. 27176-87-0	Dodecylbenzenesulfonic Acid
125. 115-29-7	Endosulfan (all isomers)
126. 72-20-8	Endrin and Metabolites
127. 106-89-8	Epichlorohydrin
128. 563-12-2	Ethion
129. 100-41-4	Ethyl Benzene
130. 107-15-3	Ethylenediamine
131. 106-93-4	Ethylene Dibromide
132. 107-06-2	Ethylene Dichloride
133. 60-00-4	EDTA
134. 1185-57-5	Ferric Ammonium Citrate
135. 2944-67-4	Ferric Ammonium Oxalate
136. 7705-08-0	Ferric Chloride

II. HAZARDOUS SUBSTANCES

CAS Number	Chemical Name
137. 7783-50-8	Ferric Fluoride
138. 10421-48-4	Ferric Nitrate
139. 10028-22-5	Ferric Sulfate
140. 10045-89-3	Ferrous Ammonium Sulfate
141. 7758-94-3	Ferrous Chloride
142. 7720-78-7	Ferrous Sulfate
143. 206-44-0	Fluoranthene
144. 50-00-0	Formaldehyde
145. 64-18-6	Formic Acid
146. 110-17-8	Fumaric Acid
147. 98-01-1	Furfural
148. 86-50-0	Guthion
149. 76-44-8	Heptachlor
150. 118-74-1	Hexachlorobenzene
151. 87-68-3	Hexachlorobutadiene
152. 67-72-1	Hexachloroethane
153. 70-30-4	Hexachlorophene
154. 77-47-4	Hexachlorocyclopentadiene
155. 7647-01-0	Hydrochloric Acid (Hydrogen Chloride)
156. 7664-39-3	Hydrofluoric Acid (Hydrogen Fluoride)
157. 74-90-8	Hydrogen Cyanide
158. 7783-06-4	Hydrogen Sulfide
159. 78-79-5	Isoprene
160. 42504-46-1	Isopropanolamine Dodecylbenzenesulfonate
161. 115-32-2	Kelthane
162. 143-50-0	Kepone
163. 301-04-2	Lead Acetate
164. 3687-31-8	Lead Arsenate
165. 7758-95-4	Lead Chloride
166. 13814-96-5	Lead Fluoborate
167. 7783-46-2	Lead Fluoride
168. 10101-63-0	Lead Iodide
169. 18256-98-9	Lead Nitrate
170. 7428-48-0	Lead Stearate
171. 15739-80-7	Lead Sulfate
172. 1314-87-0	Lead Sulfide
173. 592-87-0	Lead Thiocyanate
174. 58-89-9	Lindane
175. 14307-35-8	Lithium Chromate
176. 121-75-5	Malthion
177. 110-16-7	Maleic Acid
178. 108-31-6	Maleic Anhydride
179. 2032-65-7	Mercaptodimethur
180. 592-04-1	Mercuric Cyanide
181. 10045-94-0	Mercuric Nitrate
182. 7783-35-9	Mercuric Sulfate
183. 592-85-8	Mercuric Thiocyanate
184. 10415-75-5	Mercurous Nitrate
185. 72-43-5	Methoxychlor
186. 74-93-1	Methyl Mercaptan
187. 80-62-6	Methyl Methacrylate
188. 298-00-0	Methyl Parathion
189. 7786-34-7	Mevinphos
190. 315-18-4	Mexacarbate
191. 75-04-7	Monoethylamine
192. 74-89-5	Monomethylamine
193. 300-76-5	Naled
194. 91-20-3	Naphthalene
195. 1338-24-5	Naphthenic Acid
196. 7440-02-0	Nickel
197. 15699-18-0	Nickel Ammonium Sulfate
198. 37211-05-5	Nickel Chloride
199. 12054-48-7	Nickel Hydroxide
200. 14216-75-2	Nickel Nitrate
201. 7786-81-4	Nickel Sulfate
202. 7697-37-2	Nitric Acid
203. 98-95-3	Nitrobenzene
204. 10102-44-0	Nitrogen Dioxide
205. 25154-55-6	Nitrophenol (all isomers)
206. 1321-12-6	Nitrotoluene
207. 30525-89-4	Paraformaldehyde
208. 56-38-2	Parathion
209. 608-93-5	Pentachlorobenzene
210. 87-86-5	Pentachlorophenol
211. 85-01-8	Phenanthrene
212. 108-95-2	Phenol
213. 75-44-5	Phosgene
214. 7664-38-2	Phosphoric Acid
215. 7723-14-0	Phosphorus
216. 10025-87-3	Phosphorus Oxychloride
217. 1314-80-3	Phosphorus Pentasulfide
218. 7719-12-2	Phosphorus Trichloride
219. 7784-41-0	Potassium Arsenate
220. 10124-50-2	Potassium Arsenite
221. 7778-50-9	Potassium Bichromate
222. 7789-00-6	Potassium Chromate
223. 7722-64-7	Potassium Permanganate
224. 2312-35-8	Propargite
225. 79-09-4	Propionic Acid
226. 123-62-6	Propionic Anhydride
227. 1336-36-3	Polychlorinated Biphenyls
228. 151-50-8	Potassium Cyanide
229. 1310-58-3	Potassium Hydroxide
230. 75-56-9	Propylene Oxide
231. 121-29-9	Pyrethrins
232. 91-22-5	Quinoline
233. 108-46-3	Resorcinol
234. 7446-08-4	Selenium Oxide
235. 7761-88-8	Silver Nitrate
236. 7631-89-2	Sodium Arsenate
237. 7784-46-5	Sodium Arsenite
238. 10588-01-9	Sodium Bichromate
239. 1333-83-1	Sodium Bifluoride
240. 7631-90-5	Sodium Bisulfite
241. 7775-11-3	Sodium Chromate
242. 143-33-9	Sodium Cyanide
243. 25155-30-0	Sodium Dodecylbenzene Sulfonate
244. 7681-49-4	Sodium Fluoride
245. 16721-80-5	Sodium Hydrosulfide
246. 1310-73-2	Sodium Hydroxide
247. 7681-52-9	Sodium Hypochlorite
248. 124-41-4	Sodium Methylate
249. 7632-00-0	Sodium Nitrate
250. 7558-79-4	Sodium Phosphate, Dibasic
251. 7601-54-9	Sodium Phosphate, Tribasic
252. 10102-18-8	Sodium Selenite
253. 7789-06-2	Strontium Chromate
254. 57-24-9	Strychnine and Salts
255. 100-420-5	Styrene
256. 12771-08-3	Sulfur Monochloride
257. 7664-93-9	Sulfuric Acid
258. 93-76-5	2,4,5-T Acid
259. 2008-46-0	2,4,5-T Amines
260. 93-79-8	2,4,5-T Esters
261. 13560-99-1	2,4,5-T Salts
262. 93-72-1	2,4,5-TP Acid
263. 32534-95-5	2,4,5-TP Acid Esters
264. 72-54-8	TDE
265. 95-94-3	Tetrachlorobenzene
266. 127-18-4	Tetrachloroethane
267. 78-00-2	Tetraethyl Lead
268. 107-49-3	Tetraethyl Pyrophosphate
269. 7446-18-6	Thallium (I) Sulfate
270. 108-88-3	Toluene
271. 8001-35-2	Toxaphene
272. 12002-48-1	Trichlorobenzene (all isomers)
273. 52-68-6	Trichlorfon
274. 25323-89-1	Trichloroethane (all isomers)
275. 79-01-6	Trichloroethylene
276. 25167-82-2	Trichlorophenol (all isomers)
277. 27323-41-7	Triethanolamine Dodecylbenzenesulfonate
278. 121-44-8	Triethylamine
279. 75-50-3	Trimethylamine
280. 541-09-3	Uranyl Acetate
281. 10102-06-4	Uranyl Nitrate
282. 1314-62-1	Vanadium Pentoxide
283. 27774-13-6	Vanadyl Sulfate
284. 108-05-4	Vinyl Acetate
285. 75-35-4	Vinylidene Chloride
286. 1300-71-6	Xylenol
287. 557-34-6	Zinc Acetate
288. 52628-25-8	Zinc Ammonium Chloride
289. 1332-07-6	Zinc Borate
290. 7699-45-8	Zinc Bromide
291. 3486-35-9	Zinc Carbonate
292. 7646-85-7	Zinc Chloride
293. 557-21-1	Zinc Cyanide
294. 7783-49-3	Zinc Fluoride
295. 557-41-5	Zinc Formate
296. 7779-86-4	Zinc Hydrosulfite
297. 7779-88-6	Zinc Nitrate
298. 127-82-2	Zinc Phenolsulfonate
299. 1314-84-7	Zinc Phosphide
300. 16871-71-9	Zinc Silicofluoride
301. 7733-02-0	Zinc Sulfate
302. 13746-89-9	Zirconium Nitrate
303. 16923-95-8	Zirconium Potassium Fluoride
304. 14644-61-2	Zirconium Sulfate
305. 10026-11-6	Zirconium Tetrachloride

APPENDIX C

POTENTIAL HAZARDOUS WASTE SITE INSPECTION REPORT

United States
Environmental Protection
Agency

Office of Emergency and
Remedial Response
Washington, DC 20460

EPA Form 2070-13
July, 1981

EPA

Potential Hazardous Waste Site

Site Inspection Report

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Site Inspection Report

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 1 - SITE LOCATION AND INSPECTION INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER

II. SITE NAME AND LOCATION

01 SITE NAME *(Legal, common, or descriptive name of site)*	02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER					
03 CITY	04 STATE	05 ZIP CODE	06 COUNTY	07 COUNTY CODE	08 CONG DIST	

09 COORDINATES LATITUDE __ __ ___ . _ LONGITUDE ___ __ ___ . _

10 TYPE OF OWNERSHIP *(Check one)*
☐ A. PRIVATE ☐ B. FEDERAL ______ ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL
☐ F. OTHER ______ ☐ G. UNKNOWN

III. INSPECTION INFORMATION

01 DATE OF INSPECTION __/__/__ MONTH DAY YEAR

02 SITE STATUS ☐ ACTIVE ☐ INACTIVE

03 YEARS OF OPERATION ____ / ____ BEGINNING YEAR ENDING YEAR __ UNKNOWN

04 AGENCY PERFORMING INSPECTION *(Check all that apply)*
☐ A. EPA ☐ B. EPA CONTRACTOR ______ *(Name of firm)* ☐ C. MUNICIPAL ☐ D. MUNICIPAL CONTRACTOR ______ *(Name of firm)*
☐ E. STATE ☐ F. STATE CONTRACTOR ______ *(Name of firm)* ☐ G. OTHER ______ *(Specify)*

05 CHIEF INSPECTOR	06 TITLE	07 ORGANIZATION	08 TELEPHONE NO ( )
09 OTHER INSPECTORS	10 TITLE	11 ORGANIZATION	12 TELEPHONE NO ( )
			( )
			( )
			( )
			( )

13 SITE REPRESENTATIVES INTERVIEWED	14 TITLE	15 ADDRESS	16 TELEPHONE NO ( )
			( )
			( )
			( )
			( )
			( )

17 ACCESS GAINED BY *(Check one)* ☐ PERMISSION ☐ WARRANT	18 TIME OF INSPECTION	19 WEATHER CONDITIONS

IV. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF *(Agency/Organization)*			03 TELEPHONE NO ( )
04 PERSON RESPONSIBLE FOR SITE INSPECTION FORM	05 AGENCY	06 ORGANIZATION	07 TELEPHONE NO.	08 DATE __/__/__ MONTH DAY YEAR

EPA FORM 2070-13 (7-81)

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES *(Check all that apply)*

☐ A. SOLID
☐ B. POWDER, FINES
☐ C. SLUDGE
☐ D. OTHER ____________ *(Specify)*
☐ E. SLURRY
☐ F. LIQUID
☐ G. GAS

02 WASTE QUANTITY AT SITE *(Measures of waste quantities must be independent)*

TONS ____________

CUBIC YARDS ____________

NO. OF DRUMS ____________

03 WASTE CHARACTERISTICS *(Check all that apply)*

☐ A. TOXIC
☐ B. CORROSIVE
☐ C. RADIOACTIVE
☐ D. PERSISTENT
☐ E. SOLUBLE
☐ F. INFECTIOUS
☐ G. FLAMMABLE
☐ H. IGNITABLE
☐ I. HIGHLY VOLATILE
☐ J. EXPLOSIVE
☐ K. REACTIVE
☐ L. INCOMPATIBLE
☐ M. NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS			
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

IV. HAZARDOUS SUBSTANCES *(See Appendix for most frequently cited CAS Numbers)*

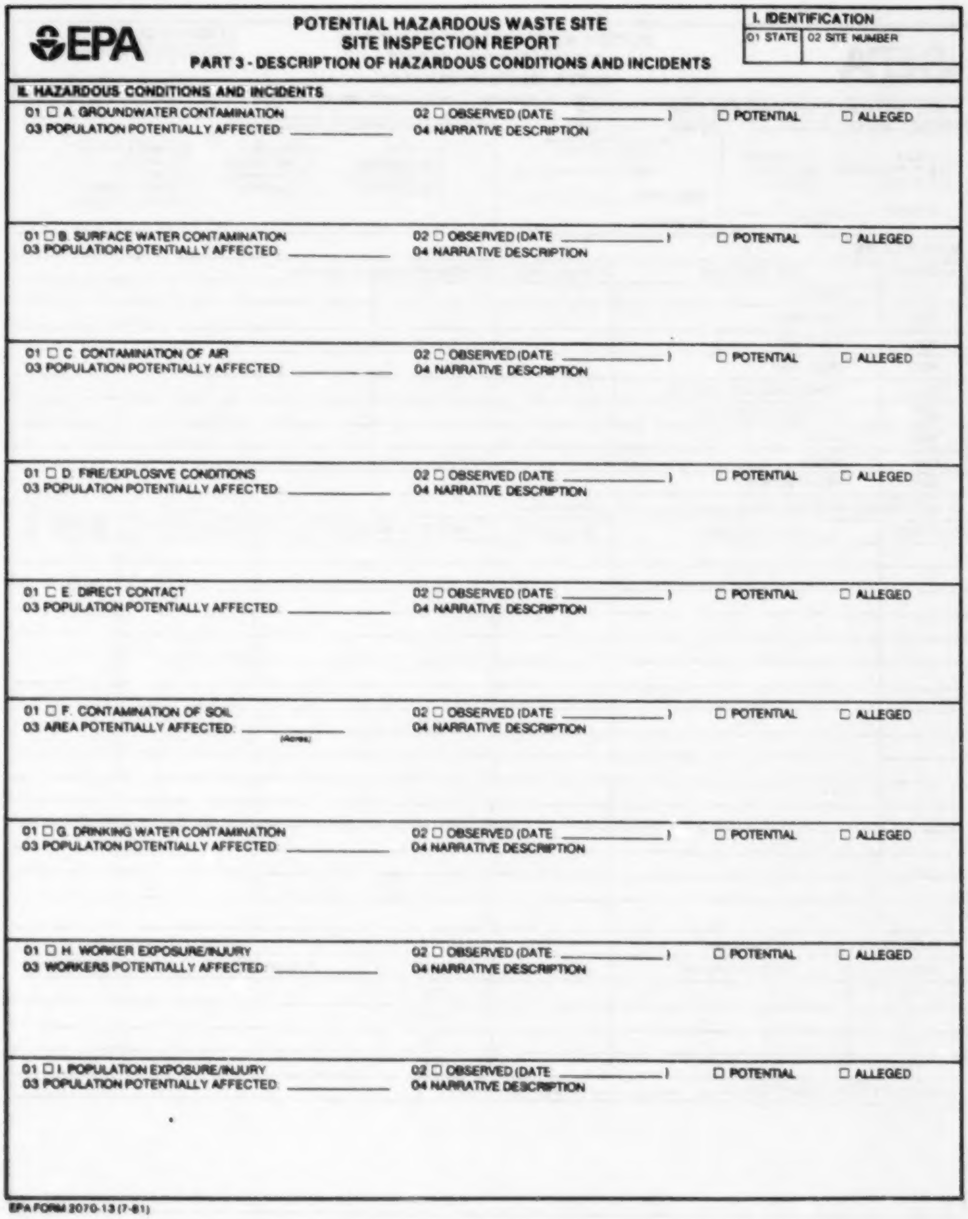
01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION

V. FEEDSTOCKS *(See Appendix for CAS Numbers)*

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analysis, reports)*

EPA FORM 2070-13 (7-81)



EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION

01 STATE	02 SITE NUMBER

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☐ A. GROUNDWATER CONTAMINATION — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED ________ 04 NARRATIVE DESCRIPTION

01 ☐ B. SURFACE WATER CONTAMINATION — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED ________ 04 NARRATIVE DESCRIPTION

01 ☐ C. CONTAMINATION OF AIR — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED ________ 04 NARRATIVE DESCRIPTION

01 ☐ D. FIRE/EXPLOSIVE CONDITIONS — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED ________ 04 NARRATIVE DESCRIPTION

01 ☐ E. DIRECT CONTACT — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED ________ 04 NARRATIVE DESCRIPTION

01 ☐ F. CONTAMINATION OF SOIL — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
03 AREA POTENTIALLY AFFECTED ________ (Acres) 04 NARRATIVE DESCRIPTION

01 ☐ G. DRINKING WATER CONTAMINATION — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED ________ 04 NARRATIVE DESCRIPTION

01 ☐ H. WORKER EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
03 WORKERS POTENTIALLY AFFECTED ________ 04 NARRATIVE DESCRIPTION

01 ☐ I. POPULATION EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED ________ 04 NARRATIVE DESCRIPTION

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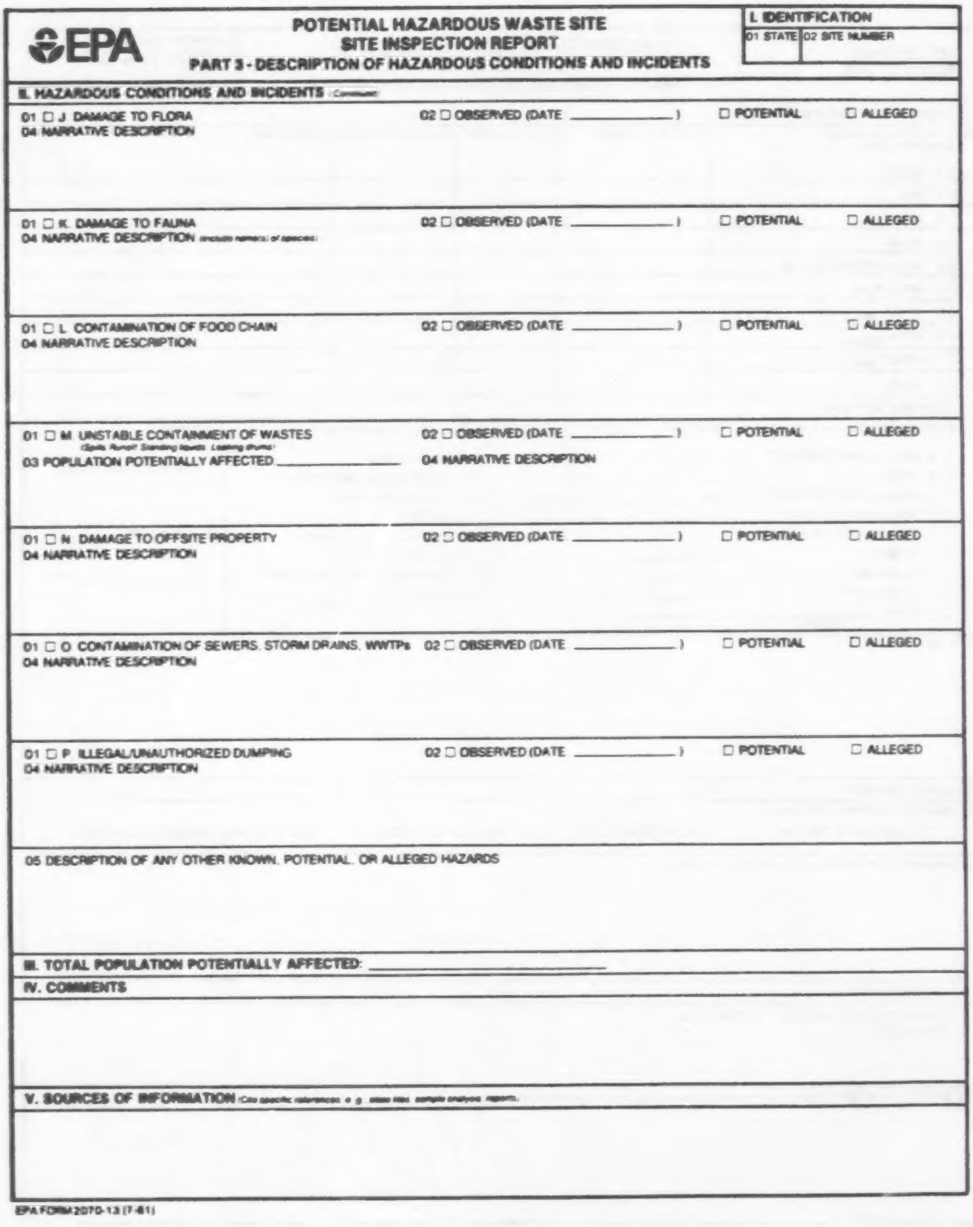

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
01 STATE
02 SITE NUMBER

II. HAZARDOUS CONDITIONS AND INCIDENTS (Continued)

01 ☐ J. DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ K. DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION (include name(s) of species)

01 ☐ L. CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ M. UNSTABLE CONTAINMENT OF WASTES (Spills, Runoff, Standing liquids, Leaking drums) — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED ________
04 NARRATIVE DESCRIPTION

01 ☐ N. DAMAGE TO OFFSITE PROPERTY — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ P. ILLEGAL/UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE ________) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS

III. TOTAL POPULATION POTENTIALLY AFFECTED: ________

IV. COMMENTS

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION
PART 4 - PERMIT AND DESCRIPTIVE INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER

II. PERMIT INFORMATION

01 TYPE OF PERMIT ISSUED (Check all that apply)	02 PERMIT NUMBER	03 DATE ISSUED	04 EXPIRATION DATE	05 COMMENTS
☐ A. NPDES				
☐ B. UIC				
☐ C. AIR				
☐ D. RCRA				
☐ E. RCRA INTERIM STATUS				
☐ F. SPCC PLAN				
☐ G. STATE (Specify)				
☐ H. LOCAL (Specify)				
☐ I. OTHER (Specify)				
☐ J. NONE				

III. SITE DESCRIPTION

01 STORAGE/DISPOSAL (Check all that apply)	02 AMOUNT	03 UNIT OF MEASURE
☐ A. SURFACE IMPOUNDMENT	______	______
☐ B. PILES	______	______
☐ C. DRUMS, ABOVE GROUND	______	______
☐ D. TANK, ABOVE GROUND	______	______
☐ E. TANK, BELOW GROUND	______	______
☐ F. LANDFILL	______	______
☐ G. LANDFARM	______	______
☐ H. OPEN DUMP	______	______
☐ I. OTHER ______ (Specify)	______	

04 TREATMENT (Check all that apply)

☐ A. INCENERATION
☐ B. UNDERGROUND INJECTION
☐ C. CHEMICAL/PHYSICAL
☐ D. BIOLOGICAL
☐ E. WASTE OIL PROCESSING
☐ F. SOLVENT RECOVERY
☐ G. OTHER RECYCLING/RECOVERY
☐ H. OTHER ______ (Specify)

05 OTHER

☐ A. BUILDINGS ON SITE

06 AREA OF SITE

______ (Acres)

07 COMMENTS

IV. CONTAINMENT

01 CONTAINMENT OF WASTES (Check one)

☐ A. ADEQUATE, SECURE ☐ B. MODERATE ☐ C. INADEQUATE, POOR ☐ D. INSECURE, UNSOUND, DANGEROUS

02 DESCRIPTION OF DRUMS, DIKING, LINERS, BARRIERS, ETC

V. ACCESSIBILITY

01 WASTE EASILY ACCESSIBLE ☐ YES ☐ NO
02 COMMENTS

VI. SOURCES OF INFORMATION (Cite specific references, e.g. state files, sample analysis, reports)

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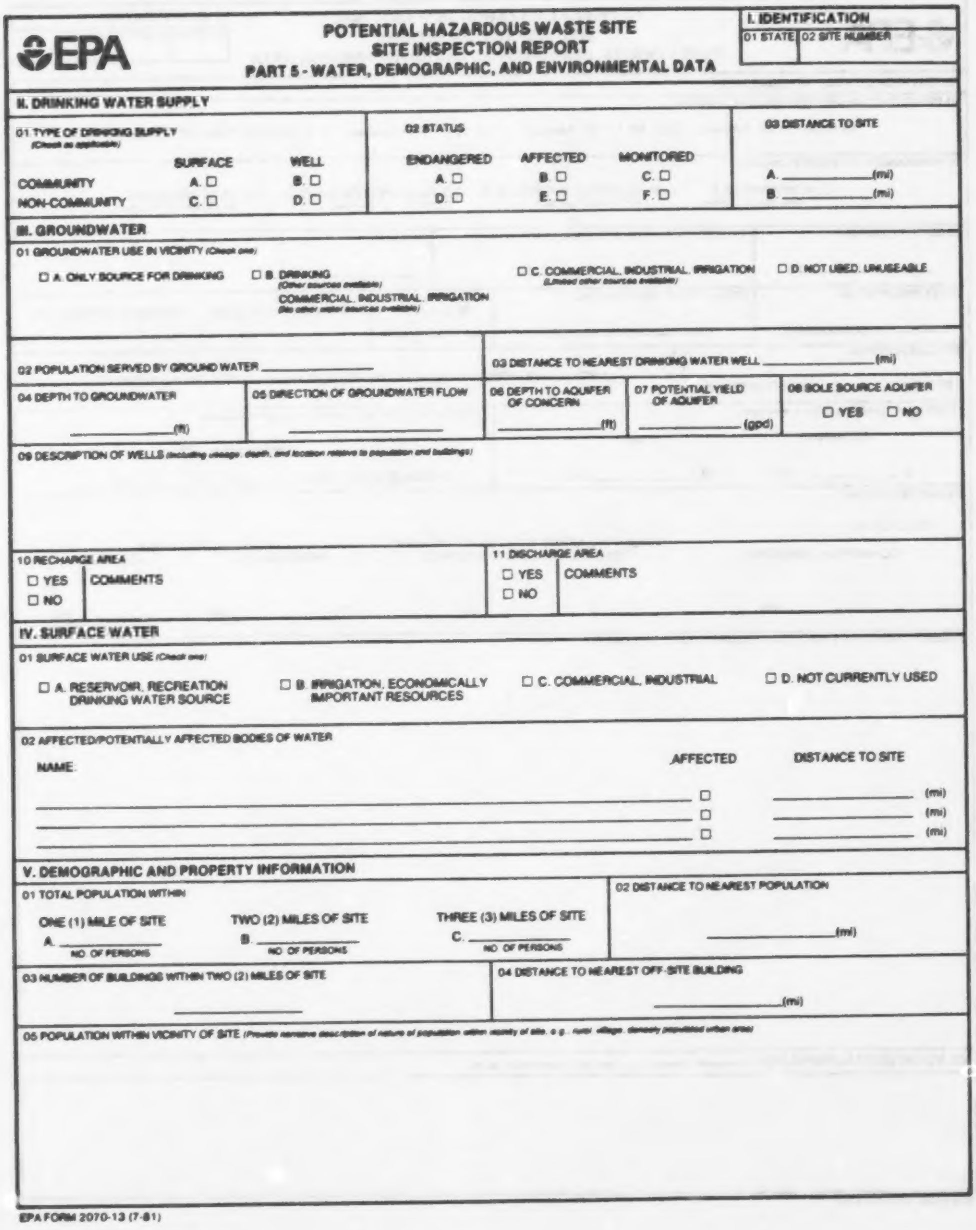

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 STATE	02 SITE NUMBER

II. DRINKING WATER SUPPLY

01 TYPE OF DRINKING SUPPLY *(Check as applicable)*

	SURFACE	WELL
COMMUNITY	A. ☐	B. ☐
NON-COMMUNITY	C. ☐	D. ☐

02 STATUS

ENDANGERED	AFFECTED	MONITORED
A. ☐	B. ☐	C. ☐
D. ☐	E. ☐	F. ☐

03 DISTANCE TO SITE

A. ____________(mi)

B. ____________(mi)

III. GROUNDWATER

01 GROUNDWATER USE IN VICINITY *(Check one)*

☐ A. ONLY SOURCE FOR DRINKING

☐ B. DRINKING *(Other sources available)* COMMERCIAL, INDUSTRIAL, IRRIGATION *(No other water sources available)*

☐ C. COMMERCIAL, INDUSTRIAL, IRRIGATION *(Limited other sources available)*

☐ D. NOT USED, UNUSEABLE

02 POPULATION SERVED BY GROUND WATER ____________

03 DISTANCE TO NEAREST DRINKING WATER WELL ____________(mi)

04 DEPTH TO GROUNDWATER ____________(ft)

05 DIRECTION OF GROUNDWATER FLOW ____________

06 DEPTH TO AQUIFER OF CONCERN ____________(ft)

07 POTENTIAL YIELD OF AQUIFER ____________ (gpd)

08 SOLE SOURCE AQUIFER ☐ YES ☐ NO

09 DESCRIPTION OF WELLS *(including usage, depth, and location relative to population and buildings)*

10 RECHARGE AREA ☐ YES ☐ NO COMMENTS

11 DISCHARGE AREA ☐ YES ☐ NO COMMENTS

IV. SURFACE WATER

01 SURFACE WATER USE *(Check one)*

☐ A. RESERVOIR, RECREATION DRINKING WATER SOURCE

☐ B. IRRIGATION, ECONOMICALLY IMPORTANT RESOURCES

☐ C. COMMERCIAL, INDUSTRIAL

☐ D. NOT CURRENTLY USED

02 AFFECTED/POTENTIALLY AFFECTED BODIES OF WATER

NAME:	AFFECTED	DISTANCE TO SITE
____________	☐	____________ (mi)
____________	☐	____________ (mi)
____________	☐	____________ (mi)

V. DEMOGRAPHIC AND PROPERTY INFORMATION

01 TOTAL POPULATION WITHIN

ONE (1) MILE OF SITE	TWO (2) MILES OF SITE	THREE (3) MILES OF SITE
A. ____________ NO. OF PERSONS	B. ____________ NO. OF PERSONS	C. ____________ NO. OF PERSONS

02 DISTANCE TO NEAREST POPULATION ____________(mi)

03 NUMBER OF BUILDINGS WITHIN TWO (2) MILES OF SITE ____________

04 DISTANCE TO NEAREST OFF-SITE BUILDING ____________(mi)

05 POPULATION WITHIN VICINITY OF SITE *(Provide narrative description of nature of population within vicinity of site, e.g., rural, village, densely populated urban area)*

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 5 - WATER, DEMOGRAPHIC, AND ENVIRONMENTAL DATA

I. IDENTIFICATION

01 STATE
02 SITE NUMBER

VI. ENVIRONMENTAL INFORMATION

01 PERMEABILITY OF UNSATURATED ZONE *(Check one)*

☐ A. $10^{-6} - 10^{-8}$ cm/sec ☐ B. $10^{-4} - 10^{-6}$ cm/sec ☐ C. $10^{-4} - 10^{-3}$ cm/sec ☐ D. GREATER THAN 10^{-3} cm/sec

02 PERMEABILITY OF BEDROCK *(Check one)*

☐ A. IMPERMEABLE *(Less than 10^{-6} cm/sec)* ☐ B. RELATIVELY IMPERMEABLE *($10^{-4} - 10^{-6}$ cm/sec)* ☐ C. RELATIVELY PERMEABLE *($10^{-2} - 10^{-4}$ cm/sec)* ☐ D. VERY PERMEABLE *(Greater than 10^{-2} cm/sec)*

03 DEPTH TO BEDROCK ______ (ft)

04 DEPTH OF CONTAMINATED SOIL ZONE ______ (ft)

05 SOIL pH ______

06 NET PRECIPITATION ______ (in)

07 ONE YEAR 24 HOUR RAINFALL ______ (in)

08 SLOPE
SITE SLOPE ______ %
DIRECTION OF SITE SLOPE
TERRAIN AVERAGE SLOPE ______ %

09 FLOOD POTENTIAL
SITE IS IN ______ YEAR FLOODPLAIN

10 ☐ SITE IS ON BARRIER ISLAND, COASTAL HIGH HAZARD AREA, RIVERINE FLOODWAY

11 DISTANCE TO WETLANDS *(5 acre minimum)*
ESTUARINE A. ______ (mi)
OTHER B. ______ (mi)

12 DISTANCE TO CRITICAL HABITAT *(of endangered species)*
______ (mi)
ENDANGERED SPECIES: ______

13 LAND USE IN VICINITY

DISTANCE TO:
COMMERCIAL/INDUSTRIAL A. ______ (mi)
RESIDENTIAL AREAS; NATIONAL/STATE PARKS, FORESTS, OR WILDLIFE RESERVES B. ______ (mi)
AGRICULTURAL LANDS
PRIME AG LAND C. ______ (mi)
AG LAND D. ______ (mi)

14 DESCRIPTION OF SITE IN RELATION TO SURROUNDING TOPOGRAPHY

VII. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analysis, reports)*

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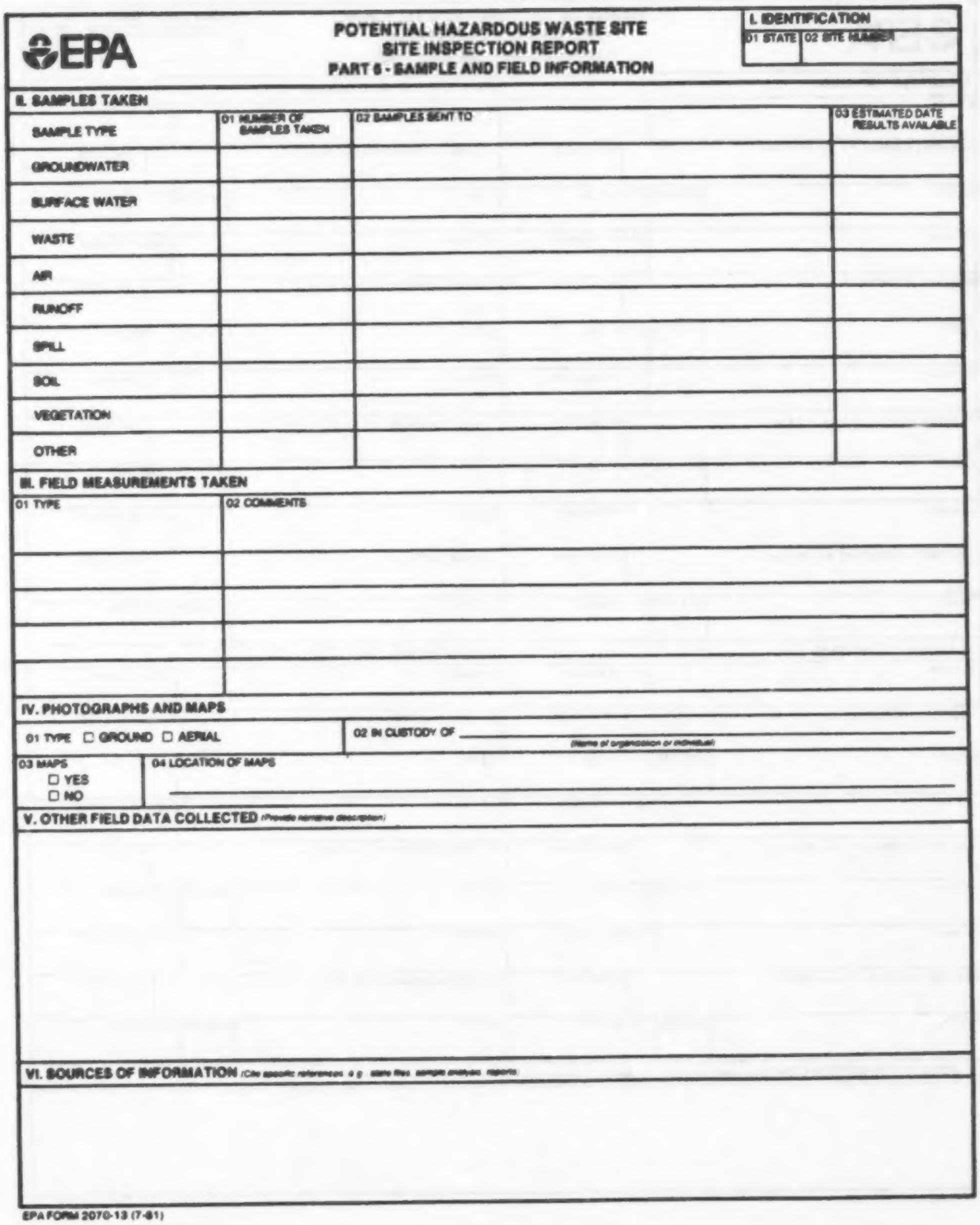

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 6 - SAMPLE AND FIELD INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER

II. SAMPLES TAKEN

SAMPLE TYPE	01 NUMBER OF SAMPLES TAKEN	02 SAMPLES SENT TO	03 ESTIMATED DATE RESULTS AVAILABLE
GROUNDWATER			
SURFACE WATER			
WASTE			
AIR			
RUNOFF			
SPILL			
SOIL			
VEGETATION			
OTHER			

III. FIELD MEASUREMENTS TAKEN

01 TYPE	02 COMMENTS

IV. PHOTOGRAPHS AND MAPS

01 TYPE ☐ GROUND ☐ AERIAL

02 IN CUSTODY OF ____________________
(Name of organization or individual)

03 MAPS
☐ YES
☐ NO

04 LOCATION OF MAPS ____________________

V. OTHER FIELD DATA COLLECTED (Provide narrative description)

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 7 - OWNER INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER

II. CURRENT OWNER(S)			**PARENT COMPANY** *(If applicable)*		
01 NAME		02 D+B NUMBER	08 NAME		09 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE	10 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		11 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	12 CITY	13 STATE	14 ZIP CODE
01 NAME		02 D+B NUMBER	08 NAME		09 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE	10 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		11 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	12 CITY	13 STATE	14 ZIP CODE
01 NAME		02 D+B NUMBER	08 NAME		09 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE	10 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		11 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	12 CITY	13 STATE	14 ZIP CODE
01 NAME		02 D+B NUMBER	08 NAME		09 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE	10 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		11 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	12 CITY	13 STATE	14 ZIP CODE
III. PREVIOUS OWNER(S) *(List most recent first)*			**IV. REALTY OWNER(S)** *(If applicable, list most recent first)*		
01 NAME		02 D+B NUMBER	01 NAME		02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE	03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE
01 NAME		02 D+B NUMBER	01 NAME		02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE	03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE
01 NAME		02 D+B NUMBER	01 NAME		02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE	03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE

V. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analyses, reports)*

EPA FORM 2070-13 (7-81)

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 8 - OPERATOR INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER

II. CURRENT OPERATOR (Provide if different from owner)

01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE
08 YEARS OF OPERATION	09 NAME OF OWNER

OPERATOR'S PARENT COMPANY (If applicable)

10 NAME	11 D+B NUMBER
12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE

III. PREVIOUS OPERATOR(S) (List most recent first; provide only if different from owner)

01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE
08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD
01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE
08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD
01 NAME	02 D+B NUMBER
03 STREET ADDRESS (P.O. Box, RFD #, etc.)	04 SIC CODE
05 CITY	06 STATE / 07 ZIP CODE
08 YEARS OF OPERATION	09 NAME OF OWNER DURING THIS PERIOD

PREVIOUS OPERATORS' PARENT COMPANIES (If applicable)

10 NAME	11 D+B NUMBER
12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE
10 NAME	11 D+B NUMBER
12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE
10 NAME	11 D+B NUMBER
12 STREET ADDRESS (P.O. Box, RFD #, etc.)	13 SIC CODE
14 CITY	15 STATE / 16 ZIP CODE

IV. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

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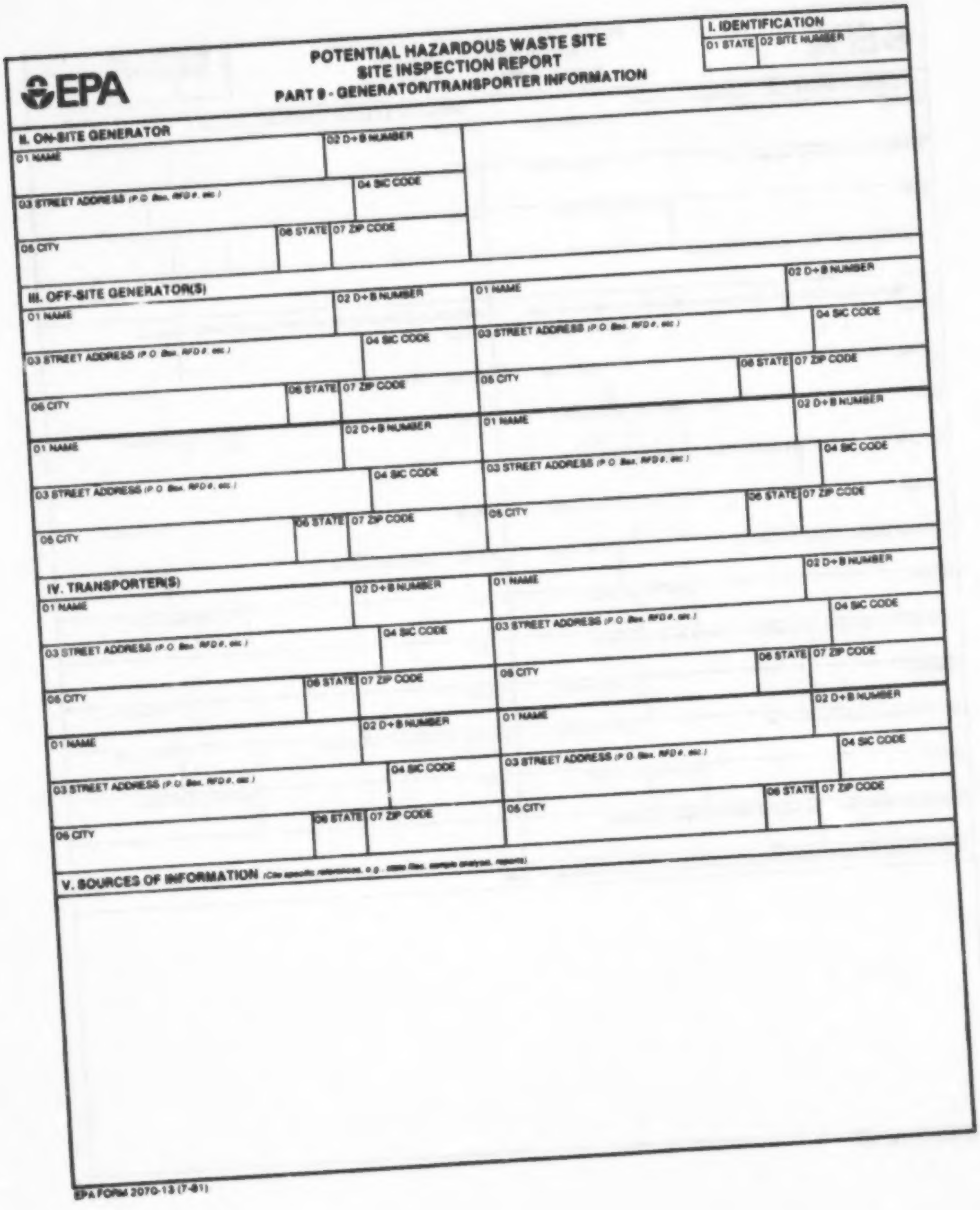

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 9 - GENERATOR/TRANSPORTER INFORMATION

I. IDENTIFICATION

01 STATE

02 SITE NUMBER

II. ON-SITE GENERATOR

01 NAME

02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)

04 SIC CODE

05 CITY

06 STATE

07 ZIP CODE

III. OFF-SITE GENERATOR(S)

01 NAME

02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)

04 SIC CODE

05 CITY

06 STATE

07 ZIP CODE

01 NAME

02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)

04 SIC CODE

05 CITY

06 STATE

07 ZIP CODE

01 NAME

02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)

04 SIC CODE

05 CITY

06 STATE

07 ZIP CODE

01 NAME

02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)

04 SIC CODE

05 CITY

06 STATE

07 ZIP CODE

IV. TRANSPORTER(S)

01 NAME

02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)

04 SIC CODE

05 CITY

06 STATE

07 ZIP CODE

01 NAME

02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)

04 SIC CODE

05 CITY

06 STATE

07 ZIP CODE

01 NAME

02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)

04 SIC CODE

05 CITY

06 STATE

07 ZIP CODE

01 NAME

02 D+B NUMBER

03 STREET ADDRESS (P.O. Box, RFD #, etc.)

04 SIC CODE

05 CITY

06 STATE

07 ZIP CODE

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

EPA FORM 2070-13 (7-81)

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 9 - GENERATOR/TRANSPORTER INFORMATION

I. IDENTIFICATION

01 STATE	02 SITE NUMBER

II. ON-SITE GENERATOR

01 NAME		02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE
05 CITY	06 STATE	07 ZIP CODE

III. OFF-SITE GENERATOR(S)

01 NAME		02 D+B NUMBER	01 NAME		02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE	03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE
01 NAME		02 D+B NUMBER	01 NAME		02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE	03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE

IV. TRANSPORTER(S)

01 NAME		02 D+B NUMBER	01 NAME		02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE	03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE
01 NAME		02 D+B NUMBER	01 NAME		02 D+B NUMBER
03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE	03 STREET ADDRESS *(P.O. Box, RFD #, etc.)*		04 SIC CODE
05 CITY	06 STATE	07 ZIP CODE	05 CITY	06 STATE	07 ZIP CODE

V. SOURCES OF INFORMATION *(Cite specific references, e.g., state files, sample analysis, reports)*

A FORM 2070-13 (7-81)

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER

II. PAST RESPONSE ACTIVITIES

01 ☐ A. WATER SUPPLY CLOSED 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ B. TEMPORARY WATER SUPPLY PROVIDED 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ C. PERMANENT WATER SUPPLY PROVIDED 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ D. SPILLED MATERIAL REMOVED 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ E. CONTAMINATED SOIL REMOVED 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ F. WASTE REPACKAGED 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ G. WASTE DISPOSED ELSEWHERE 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ H. ON SITE BURIAL 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ I. IN SITU CHEMICAL TREATMENT 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ J. IN SITU BIOLOGICAL TREATMENT 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ K. IN SITU PHYSICAL TREATMENT 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ L. ENCAPSULATION 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ M. EMERGENCY WASTE TREATMENT 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ N. CUTOFF WALLS 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ O. EMERGENCY DIKING/SURFACE WATER DIVERSION 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ P. CUTOFF TRENCHES/SUMP 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ Q. SUBSURFACE CUTOFF WALL 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

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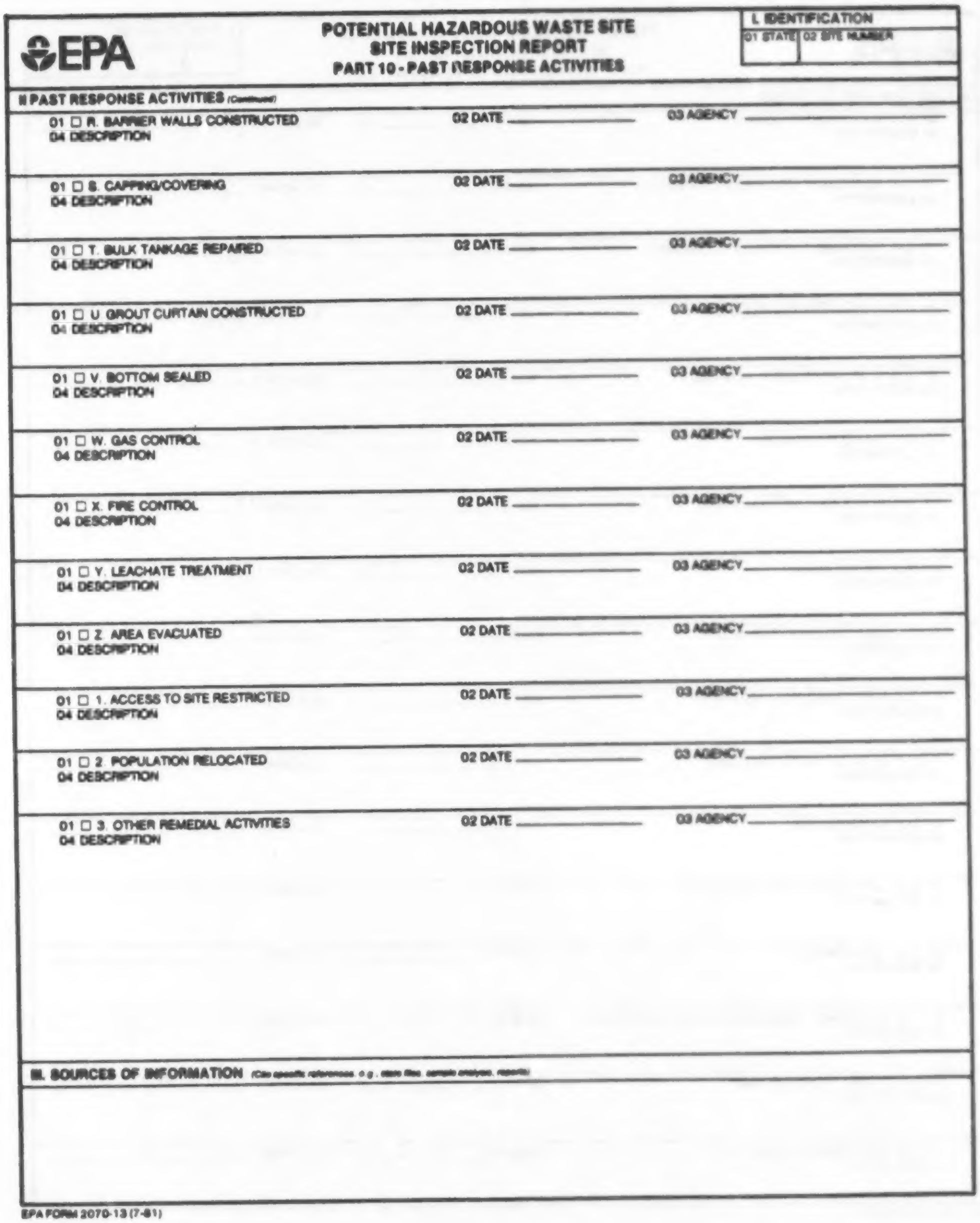

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 10 - PAST RESPONSE ACTIVITIES

I. IDENTIFICATION

01 STATE

02 SITE NUMBER

II PAST RESPONSE ACTIVITIES (Continued)

01 ☐ R. BARRIER WALLS CONSTRUCTED 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ S. CAPPING/COVERING 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ T. BULK TANKAGE REPAIRED 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ U. GROUT CURTAIN CONSTRUCTED 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ V. BOTTOM SEALED 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ W. GAS CONTROL 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ X. FIRE CONTROL 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ Y. LEACHATE TREATMENT 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ Z. AREA EVACUATED 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ 1. ACCESS TO SITE RESTRICTED 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ 2. POPULATION RELOCATED 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

01 ☐ 3. OTHER REMEDIAL ACTIVITIES 02 DATE ________ 03 AGENCY ________
04 DESCRIPTION

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT
PART 11 - ENFORCEMENT INFORMATION

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER

II. ENFORCEMENT INFORMATION

01 PAST REGULATORY/ENFORCEMENT ACTION ☐ YES ☐ NO

02 DESCRIPTION OF FEDERAL, STATE, LOCAL REGULATORY/ENFORCEMENT ACTION

III. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

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POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

General Information

The Potential Hazardous Waste Site, Site Inspection Report form is used to record information collected during, or associated with, an inspection of the site and other information about responsible parties and past response activities.

The Site Inspection Report form contains eleven parts:

Part 1 – Site Location and Inspection Information
Part 2 – Waste Information
Part 3 – Description of Hazardous Conditions and Incidents
Part 4 – Permit and Descriptive Information
Part 5 – Water, Demographic, and Environmental Data
Part 6 – Sample and Field Information
Part 7 – Owner Information
Part 8 – Operator Information
Part 9 – Generator/Transporter Information
Part 10 – Past Response Activities
Part 11 – Enforcement Information

Part 1 – Site Location and Inspection Information contains all of the data elements also contained on the Site Identification and Preliminary Assessment forms required to add a site to the automated Site Tracking System (STS). It is therefore possible to add a site to STS at the Site Inspection stage. Instructions are given below.

Part 2 – Waste Information and Part 3 – Description of Hazardous Conditions and Incidents are used to record specific information about substances, amounts, hazards, and targets, e.g., population potentially affected. Parts 2 and 3 are also contained in the Potential Hazardous Waste Site, Preliminary Assessment form. Information recorded on Part 2 and Part 3 during a preliminary assessment may be updated, added, deleted, or corrected on the Site Inspection Report form.

An Appendix with feedstock names and CAS Numbers and the most frequently cited hazardous substances and CAS Numbers is located behind the instructions for the Site Inspection Report.

A number of the data items collected throughout the Site Inspection Report support the Site Ranking Model. The majority of these data items are found in Part 5 – Water, Demographic, and Environmental Data.

General Instructions

1. Complete the Site Inspection Report form as completely as possible.

2. Starred items (*) are required before inspection information can be added to STS. The system will not accept incomplete inspection information.

3. To add a site to STS at the Site Inspection stage, write "New" across the top of the form and complete items II-01, 02, 03, 04, and 06, Site Name and Location, II-09 Coordinates, and II-10, Type of Ownership.

4. Data Items carried in STS, which are identical to those on the Site Identification and Preliminary Assessment forms and which can be added, deleted, or changed using the Site Inspection Report form, are indicated with a pound sign (#). To ensure that the proper action is taken, outline the item(s) to be added, deleted, or changed with a bright color and indicate the proper action with "A" (add), "D" (delete) or "C" (change).

5. There are two options available for adding, deleting, or changing information supplied on the Site Inspection Report form. The first is to use a new Site Inspection Report form, completing only those items to be added, deleted, or changed. Mark the form clearly, using "A", "D", or "C", to indicate the action to be taken. If only data in STS are to be altered, the Site Source Data Report may be used. Using the report, mark clearly the items to be changed and the action to be taken.

Detailed Instructions

Part 1 Site Location and Inspection Information

I. **Identification**: Identification (State and Site Number) is the site record key, or primary identifier, for the site. Site records in the STS are updated based on Identification. It is essential that State and Site Number are correctly entered on each form.

*I-01 State: Enter the two character alpha FIPS code for the state in which the site is located. It must be identical to State on the Site Identification form.

*I-02 Site Number: Enter the ten character alphanumeric code for sites which have a Dun and Bradstreet or EPA "user" Dun and Bradstreet number or the ten character numeric GSA identification code for federal sites. The Site Number must be identical to the Site Number on the Site Identification and Preliminary Assessment forms.

II. **Site Name and Location**: If Site Name and Location information require no additions or changes, these items are not required on the Site Inspection Report form. However, completing these items will facilitate use of the completed form and records management procedures.

#II-01 Site Name: Enter the legal, common, or descriptive name of the site.

#II-02 Site Street: Enter the street address and number (if appropriate) where the site is located. If the precise street address is unavailable for this site, enter brief direction identifier, e.g., NW Jct I-295 & US 99; Post Rd, 5 mi W of Rt. 5.

#II-03 Site City: Enter the city, town, village, or other municipality in which the site is located. If the site is not located in a municipality, enter the name of the municipality (or place) which is nearest the site or which most easily locates the site.

#II-04 Site State: Enter the two character alpha FIPS code for the state in which the site is located. The code must be the same as in item I-01.

#II-05 Site Zip Code: Enter the five character numeric zip code for the postal zone in which the site is located.

#II-06 Site County: Enter the name of the county, parish (Louisiana), or borough (Alaska) in which the site is located.

#II-07 County Code: Enter the three character numeric FIPS county code for the county, parish, or borough in which the site is located. (The regional data analyst can furnish this data item.)

#II-08 Site Congressional District: Enter the two character number for the congressional district in which the site is located.

*#II-09 Coordinates: Enter the Coordinates, Latitude and Longitude, of the site in degrees, minutes, seconds, and tenths of seconds. If a tenth of a second is insignificant at this site, enter "0" in the tenths position.

#II-10 Type of Ownership: Check the appropriate box to indicate the type of site ownership. If the site is under the jurisdiction of an activity of the federal government, enter the name of the department, agency, or activity. If Other is indicated, specify the type of ownership and name.

III. Inspection Information

*III-01 Date of Inspection: Enter the date the inspection occurred, or began for multiple day inspections.

*III-02 Site Status: Check the appropriate box(es) to indicate the current status of the site. Active sites are those which treat, store, or dispose of wastes. Check Active for those active sites with an inactive storage or disposal area. Inactive sites are those at which treatment, storage, or disposal activities no longer occur.

#III-03 Years of Operation: Enter the beginning and ending years (or beginning only if operations at the site are on-going), e.g., 1878/1932, of site operation. Check Unknown if years of operation are not known.

*III-04 Agency Performing Inspection: Check the appropriate box(es) to indicate parties participating in the inspection. If contractors participate, provide the name of the firm(s).

III-05 Chief Inspector: Enter the name of the chief, or lead inspector.

III-06 Title: Enter the Chief Inspector's title, e.g., Team Leader, FIT team.

III-07 Organization: Enter the name of the organization where the Chief Inspector is employed, e.g., EPA – Region 4, VA State Health Dept., Environmental Research Co.

III-08 Telephone Number: Enter the Chief Inspector's area code and local commercial telephone number.

III-09 Other Inspectors: Enter the names of other parties participating in the inspection.

III-10 Title: Enter the titles of other parties participating in the inspection.

III-11 Organization: Enter the names of the organizations where other parties participating in the inspection are employed.

III-12 Telephone Number: Enter the area code and local commercial telephone numbers of other parties participating in the inspection.

III-13 Site Representatives Interviewed: Enter the names of individuals representing responsible parties interviewed in connection with the inspection. Interviews do not necessarily occur during the inspection.

III-14 Title: Enter the titles of the individuals interviewed.

III-15 Address: Enter the business, mailing, or residential addresses of the individuals interviewed.

III-16 Telephone Number: Enter the area code and local commercial telephone numbers of the individuals interviewed.

III-17 Access Gained By: Check the appropriate box to indicate whether access to the site was gained through permission or warrant.

III-18 Time of Inspection: Using a 24-hour clock, enter the time the inspection began, e.g., for 3:24 p.m. enter 1524.

III-19 Weather Conditions: Describe the weather conditions during the site inspection, especially any unusual conditions which might affect results or observations taken.

IV. Information Available From

IV-01 Contact: Enter the name of the individual who can provide information about the site.

IV-02 Of: If appropriate, enter the name of the public or private agency, firm, or company and the organization within the agency, firm, or company of the individual named as Contact.

IV-03 Telephone Number: Enter the area code and local telephone number of the individual named as contact.

IV-04 Person Responsible for Site Inspection Report Form: Enter the name of the individual who was responsible for the information entered on the Site Inspection Report form. The person responsible for the Site Inspection Report form may be different from the individual who prepared the form.

IV-05 Agency: Enter the name of the Agency where the individual who is responsible for the Site Inspection Report form is employed.

IV-06 Organization: Enter the name of the organization within the Agency.

IV-07 Telephone Number: Enter the area code and local telephone number of the individual who is responsible for the Site Inspection Report form.

IV-08 Date: Enter the date the Site Inspection Report form was prepared.

Part 2 Waste Information

*I. **Identification**: Refer to Part 1–I.

II. **Waste States, Quantities, and Characteristics**: Waste States, Quantities, and Characteristics provide information about the physical structure and form of the waste, measures of gross amounts at the site, and the hazards posed by the waste, considering acute and chronic health effects and mobility along a pathway.

*II-01 Physical States: Check the appropriate box(es) to indicate the state(s) of waste present at the site. If Other is indicated, specify the physical state of the waste.

*II-02 Waste Quantity at Site: Enter estimates of amounts of waste at the site. Estimates may be in weight (Tons) or volume (Cubic Yards or Number of Drums). Use as many entries as are appropriate; however, measurements must be independent. For example, do not measure the same amounts of waste as both tons and cubic yards.

*II-03 Waste Characteristics: Check all appropriate entries to indicate the hazards posed by waste at the site. If waste at the site poses no hazard, check Not Applicable.

III. **Waste Category**: General categories of waste typically found are listed here. Enter the estimated gross amount of each category of waste and the appropriate unit of measure.

*III-01 Gross Amount: Gross Amount is the estimate of the amount of the waste category found at the site. Estimates should be furnished in metric tons (MT), tons (TN), cubic meters (CM), cubic yards (CY), drums (DR), acres (AC), acre feet (AF), liters (LT), or gallons (GA). Enter the estimated amount next to the appropriate waste category.

*III-02 Unit of Measure: Enter the appropriate unit of measure, MT (metric tons), TN (tons), CM (cubic meters), CY (cubic yards), DR (number of drums), AC (acres), AF (acre feet), LT (liters), or GA (gallons) next to the estimate of gross amount.

III-03 Comments: Comments may be used to further explain, or provide additional information, about particular waste categories.

IV. **Hazardous Substances**: Specific hazardous, or potentially hazardous, chemicals, mixtures, and substances found at the site are listed here. For each substance listed those data items marked with an "at" sign (@) must be included.

@IV-01 Category: Enter in front of the substance name the three character waste category from Section III which best describes the substance, e.g., OLW (Oily Waste).

@IV-02 Substance Name: Enter one of the following: the name of the substance registered with the Chemical Abstract Service, the common or accepted abbreviation of the substance, the generic name of the substance, or commercial name of the substance.

@IV-03 CAS Number: Enter the number assigned to the substance when it was registered with the Chemical Abstract Service. Refer to the Appendix for most frequently cited CAS Numbers. CAS Numbers must be furnished for each substance listed. If a CAS Number for this substance has not been assigned, enter "999".

@IV-04 Storage/Disposal Method: Enter the type of storage or disposal facility in which the substance was found: SI (surface impoundment, including pits, ponds, and lagoons), PL (pile), DR (drum), TK (tank), LF (landfill), LM (landfarm), OD (open dump).

IV-05 Concentration: Enter the concentration of the substance found in samples taken at the site.

IV-06 Measure of Concentration: Enter the appropriate unit of measure for the measured concentration of the substance found in the sample, e.g., MG/L, UG/L.

V. **Feedstocks**

V-01 Feedstock Name: If feedstocks, or substances derived from one or more feedstocks, are present at the site, enter the name of each feedstock found. See the Appendix for the feedstock list.

V-02 CAS Number: Enter the CAS Number for each feedstock named. See the Appendix for feedstock CAS Numbers.

VI. **Sources of Information**: List the sources used to obtain information for this form. Sources cited may include: sample analysis, reports, inspections, official records, or other documentation. Sources cited provide the basis for information entered on the form and may be used to obtain further information about the site.

Part 3 Description of Hazardous Conditions and Incidents

*I. **Identification**: Refer to Part 1–I.

II. **Hazardous Conditions and Incidents:**

II-01 Hazards: Indicate each hazardous, or potentially hazardous, condition known, or claimed, to exist at the site.

II-02 Observed, Potential, or Alleged: Check Observed and enter the date, or approximate date, of occurrence if a release of contaminants to the environment, or some other hazardous incident, is known to have occurred. In cases of a continuing release, e.g., groundwater contamination, enter the date, or approximate date, the condition first became apparent. If conditions exist for a potential release, check potential. Check Alleged for hazardous, or potentially hazardous, conditions claimed to exist at the site.

II-03 Population Potentially Affected: For each hazardous condition at the site, enter the number of people potentially affected. For Soil enter the number of acres potentially affected.

II-04 Narrative Description: Provide a narrative description, or explanation, of each condition. Include any additional information which further explains the condition.

II-05 Description of Any Other Known, Potential, or Alleged Hazards: Provide a narrative description of any other hazardous, or potentially hazardous, conditions at the site not covered above.

III. **Total Population Potentially Affected**: Enter the total number of people potentially affected by the existence of hazardous, or potentially hazardous, conditions at the site. Do not sum the numbers shown for each condition.

IV. **Comments**: Other information relevant to observed, potential, or alleged hazards may be entered here.

V. **Sources of Information**: List the sources used to obtain information for this form. Sources cited may include: sample analysis, reports, inspections, official records, or other documentation. Sources cited provide the basis for information entered on the form and may be used to obtain further information about the site.

Part 4 **Permit and Descriptive Information**

***I.** **Identification**: Refer to Part 1—I.

II. **Permit Information**

II-01 Type of Permit Issued: Check the appropriate box(es) to indicate the types of permits issued to the site. If state, local, or other types of environmental permits have been issued, specify the type.

II-02 Permit Number: Enter the permit number for each issued permit.

II-03 Date Issued: Enter the date each permit was issued.

II-04 Expiration Date: Enter the date each permit expires or expired.

II-05 Comments: Enter any information which further explains the types of permits issued or status of the permits.

III. **Site Description**

*III-01 Storage/Disposal: Check the appropriate box(es) to indicate the types of storage/disposal facilities found at the site. If Other is checked, specify the type of facility.

*III-02 Amount: Enter the gross amount of waste associated with each type of storage/disposal facility. Amounts may be measured in: metric tons, tons, cubic meters, cubic yards, drums, acres, acre feet, liters, or gallons.

*III-03 Unit of Measure: Enter the appropriate unit of measure for each entry. Units of measure are MT (metric tons), TN (tons), CM (cubic meters), CY (cubic yards), DR (drums), AC (acres), AF (acre feet), LT (liters), or GA (gallons).

*III-04 Treatment: If waste is treated at the site, check the appropriated box(es) to indicate treatment methods used. If Other is checked, specify treatment method.

III-05 Other: If there are buildings on site, check this box.

*III-06 Area of Site: Enter total area of site in acres.

III-07 Comments: Enter any other pertinent information.

IV. **Containment**: Containment is a measure of the natural or artificial means taken to minimize or preclude health hazards and to minimize or prevent contamination of the environment from waste at the site.

*IV-01 Containment of Wastes: Check the appropriate box to indicate the condition of containment measures at the site. When choosing the appropriate box, consider the potential for environmental contamination, i.e., the worst case for containment in conjunction with the most hazardous substances.

IV-02 Description of Drums, Diking, Liners, Barriers: Provide a narrative description of the condition of containment measures at the site, e.g., waste adequately contained, drums rusting and leaking, diking collapsing, liners leaking and contaminants leaching into soil and groundwater.

V. **Accessibility**: Accessibility is an indicator of the potential for direct contact with hazardous substances.

*V-01 Waste Easily Accessible: If there are no real barriers preventing human access to hazardous waste, check Yes, otherwise check No.

V-02 Comments: Additional information about accessibility to hazardous waste may be provided.

VI. **Sources of Information**: List the sources used to obtain information for this form. Sources cited may include: sample analysis, reports, inspections, official records, or other documentation. Sources cited provide the basis for information entered on the form and may be used to obtain further information about the site.

Part 5 **Water, Demographic, and Environmental Data**

***I.** **Identification**: Refer to Part 1—I.

II. **Drinking Water Supply**

II-01 Type of Drinking Water Supply: Check the appropriate box(es) to indicate the types and sources of drinking water within the vicinity of the site. Community refers to municipal sources. Non-community refers to private sources, e.g., private wells.

II-02 Status: Check the appropriate box(es) to indicate whether the water supply is endangered or affected by contaminants from the site. Check the appropriate box to indicate if the water supply is being monitored for possible contamination.

II-03 Distance to Site: Enter the distance in miles to the nearest tenth, hundredth, or thousandth (as needed to indicate the precision required) from the site to nearest drinking water source.

III. **Groundwater**

III-01 Groundwater Use in Vicinity: Check the appropriate box to indicate groundwater use in the vicinity of the site. The concern is to indicate the seriousness of groundwater contamination from waste at the site. Only Source for Drinking indicates that current water sources are limited to wells in the vicinity of the site. Drinking; Commercial, Industrial, Irrigation indicates that groundwater is used for drinking, but that other limited drinking sources are available and that no other sources for these additional uses are available. Commercial, Industrial, Irrigation indicates that groundwater is used for these purposes, but that limited other sources of water are available. Not used, Unuseable indicates that groundwater use in the area is not critical.

III-02 Population Served by Groundwater: Enter the number of people served by groundwater in the vicinity of the site. Population for the purposes of the Site Inspection Report includes residents and daytime workers and students but excludes transients in the neighborhood or on local highways and roads. When estimating population from aerial photographs or other sources, the conversion factor is 3.8 persons for each dwelling unit or 3 persons per acre in rural areas.

III-03 Distance to Nearest Drinking Water Well: Enter the distance in miles to the nearest tenth, hundredth, or thousandth (as needed to indicate the precision required) from the site to the nearest drinking water well.

III-04 Depth to Groundwater: Enter the depth in feet to groundwater.

III-05 Depth of Groundwater Flow: Enter the cardinal direction of groundwater flow, e.g., NNW.

III-06 Depth to Aquifer of Concern: Enter the depth in feet to the aquifer of concern.

III-07 Potential Yield of Aquifer: Enter the potential yield of the aquifer in gallons per day.

III-08 Sole Source Aquifer: Check the appropriate box to indicate the aquifer of concern is, or is not, a sole source aquifer.

III-09 Description of Wells: Provide a narrative description of wells in the vicinity of the site, including useage, depth, and location relative to population and buildings.

III-10 Recharge Area: Check the appropriate box to indicate the site is located in a recharge area. Comments provide additional information on the recharge area.

III-11 Discharge Area: Check the appropriate box to indicate the site is located in a discharge area. Comments provide additional information on the discharge area.

IV. Surface Water

IV-01 Surface Water Use: Check the appropriate box to indicate surface water use in the vicinity of the site. The order of precedence is Reservoir, Recreation, Drinking Water Source; Irrigation, Economically Important Reserves; Commercial/Industrial; Not Currently Used.

IV-02 Affected/Potentially Affected Bodies of Water: Enter the names of bodies of surface water affected, or potentially affected, by contaminants from the site. List the body of surface water nearest the site first. For each body of water check Affected if contaminants have been identified in samples of the water. Enter the shortest distance from the body of water to the site in miles to the nearest tenth, hundredth, or thousandth (as needed to indicate the precision required).

V. Demographic and Property Information

V-01 Total Population Within: Enter the total population within one (1) mile, two (2) miles, and three (3) miles of the site. Distances are measured from site boundaries. Population for the purposes of the Site Inspection Report includes residents and daytime workers and students but excludes transients in the neighborhood or on local highways and roads. When estimating population from aerial photographs or other sources, the conversion factor is 3.8 persons for each dwelling unit or 3 persons per acre in rural areas.

V-02 Distance to Nearest Population: Enter in miles to the nearest tenth, hundredth, or thousandth (as needed to indicate the precision required) the distance from the site boundary to the nearest population (one person minimum).

V-03 Number of Buildings Within Two (2) Miles of Site: Enter the number of buildings within two miles from the boundaries of the site.

V-04 Distance to Nearest Off-Site Building: Enter the distance in miles to the nearest tenth, hundredth, or thousandth (as needed to indicate the precision required) from the site boundary to the nearest off-site building.

V-05 Population in Vicinity of Site: Provide a narrative description of the nature of the population within the vicinity of the site. Examples include rural area, small truck farms, urban industrial area, densely populated urban residential area.

VI. Environmental Information

VI-01 Permeability of Unsaturated Zone: Check the appropriate box to indicate the permeability of the earth material above the water table in the vicinity of the site.

VI-02 Permeability of Bedrock: Check the appropriate box to indicate the permeability of the bedrock in the vicinity of the site.

VI-03 Depth to Bedrock: Enter the depth to bedrock in feet.

VI-04 Depth of Contaminated Soil Zone: Enter the depth of the contaminated soil zone in feet.

VI-05 Soil pH: Enter the pH of the soil in the vicinity of the site.

VI-06 Net Precipitation: Enter net precipitation in inches. If net precipitation is not known, subtract the average evaporation figure on the U.S. National Weather Service map showing average annual evaporation in inches from the U.S. Environmental Data Service map showing mean annual precipitation.

VI-07 One Year 24 Hour Rainfall: Enter in inches the figure for one year 24 hour rainfall.

VI-08 Slope: Enter the percentage of site slope, the direction of site slope, and the percentage of the surrounding terrain average slope.

VI-09 Flood Potential: Enter the boundary year for the floodplain in which the site is located. Sites flooded annually are in a 1 (one) year floodplain. Other examples include 10, 20, 50, 100, 500, etc., indicating the probability of flooding within that time period.

VI-10 Site is on Barrier Island, Coastal High Hazard Area, Riverine Floodway: If site is located in one of these areas, check this box.

VI-11 Distance to Wetlands: If applicable, enter the distance in miles to the nearest tenth, hundredth, or thousandth (as needed to indicate the precision required) from the site to the closest wetlands (five acre minimum) for Estuarine and Other types of wetlands.

VI-12 Distance to Critical Habitat: If applicable, enter the distance in miles to the nearest tenth, hundredth, or thousandth (as needed to indicate the precision required) from the site to the nearest critical habitat of an endangered species. Enter the name(s) of the endangered species.

VI-13 Land Use in Vicinity: Enter the distance in miles to the nearest tenth, hundredth, or thousandth (as needed to indicate the precision required) to the nearest Commercial/Industrial area; Residential Area, National/State Parks, Forests, or Wildlife Reserves; or Agricultural Lands, Prime Ag Land and Ag Land. Prime Ag Land is that crop, pasture, range, or forest land which produces the highest yield in relation to inputs. Ag Land is the remaining agricultural land, frequently considered marginal.

VI-14 Description of Site in Relation to Surrounding Topography: Provide a narrative description of significant or unusual aspects of the surrounding topography in relation to the site. Examples might include: site is in a valley surrounded on all sides by mountains, site is at edge of a river or stream which floods frequently, etc.

VII. **Sources of Information**: List the sources used to obtain information for this form. Sources cited may include: sample analysis, reports, inspections, official records, or other documentation. Sources cited provide the basis for information entered on the form and may be used to obtain further information about the site.

Part 6 Sample and Field Information

*I. **Identification**: Refer to Part 1—I.

II. **Samples Taken**

II-01 Number of Samples Taken: Next to each sample type enter the number of samples of that type taken.

II-02 Samples Sent To: Enter the name of the laboratory or other facility where the samples were sent for analysis.

II-03 Estimated Date Results Available: Enter the estimated date the results are expected to be available.

III. **Field Measurements Taken**

III-01 Type: Enter the type, e.g., radioactivity, explosivity, organic vapor or gas detection and analysis, reagent type gas detection, of each field measurement taken.

III-02 Comments: Describe results of field measurements, whether they were taken on or off site, and if applicable, the type of disposal facility tested, e.g., drum, surface impoundment, landfill.

IV. **Photographs and Maps**

IV-01 Type: If photographs of the site have been taken, check the appropriate box(es) to indicate the type.

IV-02 In Custody Of: Enter the name of the organization or person who has custody of the photographs.

IV-03 Maps: Check the appropriate box to indicate that maps of the site area have been prepared or obtained.

IV-04 Location of Maps: If site maps are available, indicate their location, e.g., Region 1 Air and Hazardous Materials Division.

V. **Other Field Data Collected**: Provide a narrative description of any other field data collected.

VI. **Sources of Information**: List the sources used to obtain information for this form. Sources cited may include: sample analysis, reports, inspections, official records, or other documentation. Sources cited provide the basis for information entered on the form and may be used to obtain further information about the site.

Part 7 Owner Information

*I. **Identification**: Refer to Part 1—I.

II. **Current Owner(s) — Parent Company**: Current owner(s) and parent companies, for those owners which are companies partly or wholly owned by another company, provide locator information about responsible parties. Each Part 7 provides space for four (4) current owners and their respective parent companies. If additional space is required, complete another Part 7.

II-01 Name: Enter the legal name of the owner of the site. The owner may be a firm, government agency, association, individual, etc.

II-02 D&B Number: Where available, enter the owner's D&B (Dun and Bradstreet) number. If the current owner is a federal agency, enter the GSA identification code.

II-03 Street Address: Enter the business, mailing, or residential street address of the owner.

II-04 SIC Code: If applicable, enter the owner's primary SIC Code.

II-05 City: Enter the city of the owner's business, mailing, or residential address.

II-06 State: Enter the two character alpha FIPS code for the state of the owner's business, mailing, or residential address.

II-07 Zip Code: Enter the five digit zip code for the owner's business, mailing, or residential address.

II-08 Name: If the owner is a partly or wholly owned subsidiary of another company, enter the legal name of the owner's parent company.

II-09 D&B Number: Enter the parent company's Dun and Bradstreet number.

II-10 Street Address: Enter the business or mailing street address of the parent company.

II-11 SIC Code: If applicable, enter the parent company's primary SIC code.

II-12 City: Enter the city of the parent company's business or mailing address.

II-13 State: Enter the two character alpha FIPS code for the state of the parent company's business or mailing address.

II-14 Zip Code: Enter the five digit zip code for the parent company's business or mailing address.

III. **Previous Owner(s)**: List previous owners in reverse chronological order, i.e., most recent first. If additional space is required, complete another Part 7.

III-01 Name: Enter the legal name of the previous owner. The previous owner may have been a firm, government agency, association, individual, etc.

III-02 D&B Number: Enter the previous owner's Dun and Bradstreet number if available. If the previous owner was a federal agency, enter the GSA identification code if available.

III-03 Street Address: Enter the business, mailing, or residential street address of the previous owner.

III-04 SIC Code: If applicable, enter the primary SIC Code of the previous owner.

III-05 City: Enter the city of the previous owner's business, mailing, or residential address.

III-06 State: Enter the two character alpha FIPS code for the state of the previous owner's business, mailing, or residential address.

III-07 Zip Code: Enter the zip code of the previous owner's business, mailing, or residential address.

IV. **Realty Owner(s)**: Realty owner applies when the owner leased to another entity property which was used for the storage or disposal of hazardous waste. List current or most recent first.

IV-01 Name: Enter the legal name of the realty owner. The realty owner may be a firm, government agency, association, individual, etc.

IV-02 D&B Number: Enter the previous owner's Dun and Bradstreet number if available. If the previous owner was a federal agency, enter the GSA identification code if available.

IV-03 Street Address: Enter the realty owner's business, mailing, or residential street address.

IV-04 SIC Code: If applicable, enter the realty owner's primary SIC Code.

IV-05 City: Enter the city of the realty owner's business, mailing, or residential address.

IV-06 State: Enter the two character alpha FIPS code for the state of the realty owner's business, mailing, or residential address.

IV-07 Zip Code: Enter the zip code of the realty owner's business, mailing, or residential address.

V. **Sources of Information**: List the sources used to obtain information for this form. Sources cited may include: sample analysis, reports, inspections, official records, or other documentation. Sources cited provide the basis for information entered on the form and may be used to obtain further information about the site.

Part 8 Operator Information

*I. **Identification**: Refer to Part 1–I.

II. **Current Operator–Operator's Parent Company**: Information on operators is applicable when the operator is not the owner.

II-01 Name: Enter the legal name of the operator. The operator may be a firm, government agency, association, individual, etc.

II-02 D&B Number: Enter the operator's Dun and Bradstreet number if available. If the operator is a federal agency, enter the GSA identification code if available.

II-03 Street Address: Enter the operator's business, mailing, or residential street address.

II-04 SIC Code: If applicable, enter the operator's primary SIC Code.

II-05 City: Enter the city of the operator's business, mailing, or residential address.

II-06 State: Enter the two character alpha FIPS code for the state of the operator's business, mailing, or residential address.

II-07 Zip Code: Enter the zip code of the operator's business, mailing, or residential address.

II-08 Years of Operation: Enter the beginning and ending years (or beginning only if operations are on-going), e.g., 1932/1948, of operation at the site.

II-09 Name of Owner: Enter the name of the owner for the period cited for this operator.

II-10 Name: If applicable, enter the legal name of the operator's parent company.

II-11 D&B Number: Enter the operator's parent company Dun and Bradstreet number if available.

II-12 Street Address: Enter the operator's parent company business, mailing, or residential street address.

II-13 SIC Code: If applicable, enter the operator's parent company primary SIC Code.

II-14 City: Enter the city of the operator's parent company business, mailing, or residential address.

II-15 State: Enter the two character alpha FIPS code for the state of the operator's parent company business, mailing, or residential address.

II-16 Zip Code: Enter the zip code of the operator's parent company business, mailing, or residential address.

III. **Previous Operator(s)–Previous Operators' Parent Companies**

III-01 Name: Enter the legal name of the previous operator. The previous operator may be a firm, government agency, association, individual, etc.

III-02 D&B Number: Enter the previous operator's Dun and Bradstreet number if available. If the previous operator was a federal agency, enter the GSA identification code if available.

III-03 Street Address: Enter the previous operator's business, mailing, or residential street address.

III-04 SIC Code: If applicable, enter the previous operator's primary SIC Code.

III-05 City: Enter the city of the previous operator's business, mailing, or residential address.

III-06 State: Enter the two character alpha FIPS code for the state of the previous operator's business, mailing, or residential address.

III-07 Zip Code: Enter the zip code of the previous operator's business, mailing, or residential address.

III-08 Years of Operation: Enter the beginning and ending years of operation for this operator at the site.

III-09 Name of Owner: Enter the name of the owner for the period cited for this operator.

III-10 Name: If applicable, enter the legal name of the previous operator's parent company.

III-11 D&B Number: Enter the previous operator's parent company Dun and Bradstreet number if available.

III-12 Street Address: Enter the previous operator's parent company business, mailing, or residential street address.

III-13 SIC Code: If applicable, enter the previous operator's parent company primary SIC Code.

III-14 City: Enter the city of the previous operator's parent company business, mailing, or residential address.

III-15 State: Enter the two character alpha FIPS code for the state of the previous operator's parent company business, mailing, or residential address.

III-16 Zip Code: Enter the zip code of the previous operator's parent company business, mailing, or residential address.

IV. **Sources of Information**: List the sources used to obtain information for this form. Sources cited may include: sample analysis, reports, inspections, official records, or other documentation. Sources cited provide the basis for information entered on the form and may be used to obtain further information about the site.

Part 9 Generator/Transporter Information

*I. **Identification**: Refer to Part 1–I.

II. **On-Site Generator**: A company or agency, located within the contiguous area of the site and generating waste disposed on the site, is entered here.

II-01 Name: If there is an on-site generator, enter the legal name of the on-site generator. The on-site generator may be a firm or government agency.

II-02 D&B Number: Where available, enter the on-site generator's D&B (Dun and Bradstreet) number. If the on-site generator is a federal agency, enter the GSA identification code.

II-03 Street Address: Enter the business or mailing street address of the on-site generator.

II-04 SIC Code: If applicable, enter the on-site generator's primary SIC Code.

II-05 City: Enter the city of the on-site generator's business or mailing address.

II-06 State: Enter the two character alpha FIPS code for the state of the on-site generator's business or mailing address.

II-07 Zip Code: Enter the five digit zip code for the on-site generator's business or mailing address.

III. **Off-Site Generator(s)**: Those companies or agencies off-site who have generated waste which has been disposed at the site are listed here.

III-01 Name: Enter the legal name of the off-site generator. The off-site generator may be a firm or government agency.

III-02 D&B Number: Where available, enter the off-site generator's D&B (Dun and Bradstreet) number. If the off-site generator is a federal agency, enter the GSA identification code.

III-03 Street Address: Enter the business or mailing street address of the off-site generator.

III-04 SIC Code: If applicable, enter the off-site generator's primary SIC Code.

III-05 City: Enter the city of the off-site generator's business or mailing address.

III-06 State: Enter the two character alpha FIPS code for the state of the off-site generator's business or mailing address.

III-07 Zip Code: Enter the five digit zip code for the off-site generator's business or mailing address.

IV. **Transporter(s)**: Those carriers who are known to have transported waste to the site are listed here.

IV-01 Name: Enter the legal name of the transporter. The transporter may be a firm, government agency, association, individual, etc.

IV-02 D&B Number: Where available, enter the transporter's D&B (Dun and Bradstreet) number. If the transporter is a federal agency, enter the GSA identification code.

IV-03 Street Address: Enter the business, mailing, or residential street address of the transporter.

IV-04 SIC Code: If applicable, enter the transporter's primary SIC Code.

IV-05 City: Enter the city of the transporter's business, mailing, or residential address.

IV-06 State: Enter the two character alpha FIPS code for the state of the transporter's business, mailing, or residential address.

IV-07 Zip Code: Enter the five digit zip code for the transporter's business, mailing, or residential address.

V. **Sources of Information**: List the sources used to obtain information for this form. Sources cited may include: sample analysis, reports, inspections, official records, or other documentation. Sources cited provide the basis for information entered on the form and may be used to obtain further information about the site.

Part 10 Past Response Activities

*I. **Identification**: Refer to Part 1–I.

II. **Past Response Activities**

II-01 Past Response Activities: Check the appropriate box(es) to indicate response activities initiated prior to the passage of CERCLA, December, 1980.

II-02 Date: Enter the start date (or approximate date) of the activity.

II-03 Agency: Enter the name of the Agency responsible for the activity.

II-04 Description: Provide a brief narrative description of the activity.

III. **Sources of Information**: List the sources used to obtain information for this form. Sources cited may include: sample analysis, reports, inspections, official records, or other documentation. Sources cited provide the basis for information entered on the form and may be used to obtain further information about the site.

Part 11 Enforcement Information

***I. Identification**: Refer to Part 1–I.

II. Enforcement Information

II-01 Past Regulatory/Enforcement Action: Check the appropriate box to indicate past regulatory or enforcement action at the federal, state, or local level related to this site.

II-02 Description of Federal, State, Local Regulatory or Enforcement Action: Provide a narrative description of regulatory or enforcement action to date. Do not include any enforcement action contemplated in the process of development.

III. Sources of Information: List the sources used to obtain information for this form. Sources cited may include: sample analysis, reports, inspections, official records, or other documentation. Sources cited provide the basis for information entered on the form and may be used to obtain further information about the site.

APPENDIX

I. FEEDSTOCKS

CAS Number	Chemical Name
1. 7664-41-7	Ammonia
2. 7440-36-0	Antimony
3. 1309-64-4	Antimony Trioxide
4. 7440-38-2	Arsenic
5. 1327-53-3	Arsenic Trioxide
6. 21109-95-5	Barium Sulfide
7. 7726-95-6	Bromine
8. 106-99-0	Butadiene
9. 7440-43-9	Cadmium
10. 7782-50-5	Chlorine
11. 12737-27-8	Chromite
12. 7440-47-3	Chromium
13. 7440-48-4	Cobalt
14. 1317-38-0	Cupric Oxide
15. 7758-98-7	Cupric Sulfate
16. 1317-39-1	Cuprous Oxide
17. 74-85-1	Ethylene
18. 7647-01-0	Hydrochloric Acid
19. 7664-39-3	Hydrogen Fluoride
20. 1335-25-7	Lead Oxide
21. 7439-97-6	Mercury
22. 74-82-8	Methane
23. 91-20-3	Napthalene
24. 7440-02-0	Nickel
25. 7697-37-2	Nitric Acid
26. 7723-14-0	Phosphorus
27. 7778-50-9	Potassium Dichromate
28. 1310-58-3	Potassium Hydroxide
29. 115-07-1	Propylene
30. 10588-01-9	Sodium Dichromate
31. 1310-73-2	Sodium Hydroxide
32. 7646-78-8	Stannic Chloride
33. 7772-99-8	Stannous Chloride
34. 7664-93-9	Sulfuric Acid
35. 108-88-3	Toluene
36. 1330-20-7	Xylene
37. 7646-85-7	Zinc Chloride
38. 7733-02-0	Zinc Sulfate

II. HAZARDOUS SUBSTANCES

CAS Number	Chemical Name
1. 75-07-0	Acetaldehyde
2. 64-19-7	Acetic Acid
3. 108-24-7	Acetic Anhydride
4. 75-86-5	Acetone Cyanohydrin
5. 506-96-7	Acetyl Bromide
6. 75-36-5	Acetyl Chloride
7. 107-02-8	Acrolein
8. 107-13-1	Acrylonitrile
9. 124-04-9	Adipic Acid
10. 309-00-2	Aldrin
11. 10043-01-3	Aluminum Sulfate
12. 107-18-6	Allyl Alcohol
13. 107-05-1	Allyl Chloride
14. 7664-41-7	Ammonia
15. 631-61-8	Ammonium Acetate
16. 1863-63-4	Ammonium Benzoate
17. 1066-33-7	Ammonium Bicarbonate
18. 7789-09-5	Ammonium Bichromate
19. 1341-49-7	Ammonium Bifluoride
20. 10192-30-0	Ammonium Bisulfite
21. 1111-78-0	Ammonium Carbamate
22. 12125-02-9	Ammonium Chloride
23. 7788-98-9	Ammonium Chromate
24. 3012-65-5	Ammonium Citrate, Dibasic
25. 13826-83-0	Ammonium Fluoborate
26. 12125-01-8	Ammonium Fluoride
27. 1336-21-6	Ammonium Hydroxide
28. 6009-70-7	Ammonium Oxalate
29. 16919-19-0	Ammonium Silicofluoride
30. 7773-06-0	Ammonium Sulfamate
31. 12135-76-1	Ammonium Sulfide
32. 10196-04-0	Ammonium Sulfite
33. 14307-43-8	Ammonium Tartrate
34. 1762-95-4	Ammonium Thiocyanate
35. 7783-18-8	Ammonium Thiosulfate
36. 628-63-7	Amyl Acetate
37. 62-53-3	Aniline
38. 7647-18-9	Antimony Pentachloride
39. 7789-61-9	Antimony Tribromide
40. 10025-91-9	Antimony Trichloride
41. 7783-56-4	Antimony Trifluoride
42. 1309-64-4	Antimony Trioxide
43. 1303-32-8	Arsenic Disulfide
44. 1303-28-2	Arsenic Pentoxide
45. 7784-34-1	Arsenic Trichloride
46. 1327-53-3	Arsenic Trioxide
47. 1303-33-9	Arsenic Trisulfide
48. 542-62-1	Barium Cyanide
49. 71-43-2	Benzene
50. 65-85-0	Benzoic Acid
51. 100-47-0	Benzonitrile
52. 98-88-4	Benzoyl Chloride
53. 100-44-7	Benzyl Chloride
54. 7440-41-7	Beryllium
55. 7787-47-5	Beryllium Chloride
56. 7787-49-7	Beryllium Fluoride
57. 13597-99-4	Beryllium Nitrate
58. 123-86-4	Butyl Acetate
59. 84-74-2	n-Butyl Phthalate
60. 109-73-9	Butylamine
61. 107-92-6	Butyric Acid
62. 543-90-8	Cadimium Acetate
63. 7789-42-6	Cadmium Bromide
64. 10108-64-2	Cadmium Chloride
65. 7778-44-1	Calcium Arsenate
66. 52740-16-6	Calcium Arsenite
67. 75-20-7	Calcium Carbide
68. 13765-19-0	Calcium Chromate
69. 592-01-8	Calcium Cyanide
70. 26264-06-2	Calcium Dodecylbenzene Sulfonate
71. 7778-54-3	Calcium Hypochlorite
72. 133-06-2	Captan
73. 63-25-2	Carbaryl
74. 1563-66-2	Carbofuran
75. 75-15-0	Carbon Disulfide
76. 56-23-5	Carbon Tetrachloride
77. 57-74-9	Chlordane
78. 7782-50-5	Chlorine
79. 108-90-7	Chlorobenzene
80. 67-66-3	Chloroform
81. 7790-94-5	Chlorosulfonic Acid
82. 2921-88-2	Chlorpyrifos
83. 1066-30-4	Chromic Acetate
84. 7738-94-5	Chromic Acid
85. 10101-53-8	Chromic Sulfate
86. 10049-05-5	Chromous Chloride
87. 544-18-3	Cobaltous Formate
88. 14017-41-5	Cobaltous Sulfamate
89. 56-72-4	Coumaphos
90. 1319-77-3	Cresol
91. 4170-30-3	Crotonaldehyde
92. 142-71-2	Cupric Acetate
93. 12002-03-8	Cupric Acetoarsenite
94. 7447-39-4	Cupric Chloride
95. 3251-23-8	Cupric Nitrate
96. 5893-66-3	Cupric Oxalate
97. 7758-98-7	Cupric Sulfate
98. 10380-29-7	Cupric Sulfate Ammoniated
99. 815-82-7	Cupric Tartrate
100. 506-77-4	Cyanogen Chloride
101. 110-82-7	Cyclohexane
102. 94-75-7	2,4-D Acid
103. 94-11-1	2,4-D Esters
104. 50-29-3	DDT
105. 333-41-5	Diazinon
106. 1918-00-9	Dicamba
107. 1194-65-6	Dichlobenil
108. 117-80-6	Dichlone
109. 25321-22-6	Dichlorobenzene (all isomers)
110. 266-38-19-7	Dichloropropene (all isomers)
111. 26952-23-8	Dichloropropene (all isomers)
112. 8003-19-8	Dichloropropene-Dichloropropane Mixture
113. 75-99-0	2-2-Dichloropropionic Acid
114. 62-73-7	Dichlorvos
115. 60-57-1	Dieldrin
116. 109-89-7	Diethylamine
117. 124-40-3	Dimethylamine
118. 25154-54-5	Dinitrobenzene (all isomers)
119. 51-28-5	Dinitrophenol
120. 25321-14-6	Dinitrotoluene (all isomers)
121. 85-00-7	Diquat
122. 298-04-4	Disulfoton
123. 330-54-1	Diuron
124. 27176-87-0	Dodecylbenzenesulfonic Acid
125. 115-29-7	Endosulfan (all isomers)
126. 72-20-8	Endrin and Metabolites
127. 106-89-8	Epichlorohydrin
128. 563-12-2	Ethion
129. 100-41-4	Ethyl Benzene
130. 107-15-3	Ethylenediamine
131. 106-93-4	Ethylene Dibromide
132. 107-06-2	Ethylene Dichloride
133. 60-00-4	EDTA
134. 1185-57-5	Ferric Ammonium Citrate
135. 2944-67-4	Ferric Ammonium Oxalate
136. 7705-08-0	Ferric Chloride

II. HAZARDOUS SUBSTANCES

CAS Number	Chemical Name
137. 7783-50-8	Ferric Fluoride
138. 10421-48-4	Ferric Nitrate
139. 10028-22-5	Ferric Sulfate
140. 10045-89-3	Ferrous Ammonium Sulfate
141. 7758-94-3	Ferrous Chloride
142. 7720-78-7	Ferrous Sulfate
143. 206-44-0	Fluoranthene
144. 50-00-0	Formaldehyde
145. 64-18-6	Formic Acid
146. 110-17-8	Fumaric Acid
147. 98-01-1	Furfural
148. 86-50-0	Guthion
149. 76-44-8	Heptachlor
150. 118-74-1	Hexachlorobenzene
151. 87-68-3	Hexachlorobutadiene
152. 67-72-1	Hexachloroethane
153. 70-30-4	Hexachlorophene
154. 77-47-4	Hexachlorocyclopentadiene
155. 7647-01-0	Hydrochloric Acid (Hydrogen Chloride)
156. 7664-39-3	Hydrofluoric Acid (Hydrogen Fluoride)
157. 74-90-8	Hydrogen Cyanide
158. 7783-06-4	Hydrogen Sulfide
159. 78-79-5	Isoprene
160. 42504-46-1	Isopropanolamine Dodecylbenzenesulfonate
161. 115-32-2	Kelthane
162. 143-50-0	Kepone
163. 301-04-2	Lead Acetate
164. 3687-31-8	Lead Arsenate
165. 7758-95-4	Lead Chloride
166. 13814-96-5	Lead Fluoborate
167. 7783-46-2	Lead Fluoride
168. 10101-63-0	Lead Iodide
169. 18256-98-9	Lead Nitrate
170. 7428-48-0	Lead Stearate
171. 15739-80-7	Lead Sulfate
172. 1314-87-0	Lead Sulfide
173. 592-87-0	Lead Thiocyanate
174. 58-89-9	Lindane
175. 14307-35-8	Lithium Chromate
176. 121-75-5	Malthion
177. 110-16-7	Maleic Acid
178. 108-31-6	Maleic Anhydride
179. 2032-65-7	Mercaptodimethur
180. 592-04-1	Mercuric Cyanide
181. 10045-94-0	Mercuric Nitrate
182. 7783-35-9	Mercuric Sulfate
183. 592-85-8	Mercuric Thiocyanate
184. 10415-75-5	Mercurous Nitrate
185. 72-43-5	Methoxychlor
186. 74-93-1	Methyl Mercaptan
187. 80-62-6	Methyl Methacrylate
188. 298-00-0	Methyl Parathion
189. 7786-34-7	Mevinphos
190. 315-18-4	Mexacarbate
191. 75-04-7	Monoethylamine
192. 74-89-5	Monomethylamine
193. 300-76-5	Naled
194. 91-20-3	Naphthalene
195. 1338-24-5	Naphthenic Acid
196. 7440-02-0	Nickel
197. 15699-18-0	Nickel Ammonium Sulfate
198. 37211-05-5	Nickel Chloride
199. 12054-48-7	Nickel Hydroxide
200. 14216-75-2	Nickel Nitrate
201. 7786-81-4	Nickel Sulfate
202. 7697-37-2	Nitric Acid
203. 98-95-3	Nitrobenzene
204. 10102-44-0	Nitrogen Dioxide
205. 25154-55-6	Nitrophenol (all isomers)
206. 1321-12-6	Nitrotoluene
207. 30525-89-4	Paraformaldehyde
208. 56-38-2	Parathion
209. 608-93-5	Pentachlorobenzene
210. 87-86-5	Pentachlorophenol
211. 85-01-8	Phenanthrene
212. 108-95-2	Phenol
213. 75-44-5	Phosgene
214. 7664-38-2	Phosphoric Acid
215. 7723-14-0	Phosphorus
216. 10025-87-3	Phosphorus Oxychloride
217. 1314-80-3	Phosphorus Pentasulfide
218. 7719-12-2	Phosphorus Trichloride
219. 7784-41-0	Potassium Arsenate
220. 10124-50-2	Potassium Arsenite
221. 7778-50-9	Potassium Bichromate
222. 7789-00-6	Potassium Chromate
223. 7722-64-7	Potassium Permanganate
224. 2312-35-8	Propargite
225. 79-09-4	Propionic Acid
226. 123-62-6	Propionic Anhydride
227. 1336-36-3	Polychlorinated Biphenyls
228. 151-50-8	Potassium Cyanide
229. 1310-58-3	Potassium Hydroxide
230. 75-56-9	Propylene Oxide
231. 121-29-9	Pyrethrins
232. 91-22-5	Quinoline
233. 108-46-3	Resorcinol
234. 7446-08-4	Selenium Oxide
235. 7761-88-8	Silver Nitrate
236. 7631-89-2	Sodium Arsenate
237. 7784-46-5	Sodium Arsenite
238. 10588-01-9	Sodium Bichromate
239. 1333-83-1	Sodium Bifluoride
240. 7631-90-5	Sodium Bisulfite
241. 7775-11-3	Sodium Chromate
242. 143-33-9	Sodium Cyanide
243. 25155-30-0	Sodium Dodecylbenzene Sulfonate
244. 7681-49-4	Sodium Fluoride
245. 16721-80-5	Sodium Hydrosulfide
246. 1310-73-2	Sodium Hydroxide
247. 7681-52-9	Sodium Hypochlorite
248. 124-41-4	Sodium Methylate
249. 7632-00-0	Sodium Nitrate
250. 7558-79-4	Sodium Phosphate, Dibasic
251. 7601-54-9	Sodium Phosphate, Tribasic
252. 10102-18-8	Sodium Selenite
253. 7789-06-2	Strontium Chromate
254. 57-24-9	Strychnine and Salts
255. 100-42-5	Styrene
256. 12771-08-3	Sulfur Monochloride
257. 7664-93-9	Sulfuric Acid
258. 93-76-5	2,4,5-T Acid
259. 2008-46-0	2,4,5-T Amines
260. 93-79-8	2,4,5-T Esters
261. 13560-99-1	2,4,5-T Salts
262. 93-72-1	2,4,5-TP Acid
263. 32534-95-5	2,4,5-TP Acid Esters
264. 72-54-8	TDE
265. 95-94-3	Tetrachlorobenzene
266. 127-18-4	Tetrachloroethane
267. 78-00-2	Tetraethyl Lead
268. 107-49-3	Tetraethyl Pyrophosphate
269. 7446-18-6	Thallium (I) Sulfate
270. 108-88-3	Toluene
271. 8001-35-2	Toxaphene
272. 12002-48-1	Trichlorobenzene (all isomers)
273. 52-68-6	Trichlorfon
274. 25323-89-1	Trichloroethane (all isomers)
275. 79-01-6	Trichloroethylene
276. 25167-82-2	Trichlorophenol (all isomers)
277. 27323-41-7	Triethanolamine Dodecylbenzenesulfonate
278. 121-44-8	Triethylamine
279. 75-50-3	Trimethylamine
280. 541-09-3	Uranyl Acetate
281. 10102-06-4	Uranyl Nitrate
282. 1314-62-1	Vanadium Pentoxide
283. 27774-13-6	Vanadyl Sulfate
284. 108-05-4	Vinyl Acetate
285. 75-35-4	Vinylidene Chloride
286. 1300-71-6	Xylenol
287. 557-34-6	Zinc Acetate
288. 52628-25-8	Zinc Ammonium Chloride
289. 1332-07-6	Zinc Borate
290. 7699-45-8	Zinc Bromide
291. 3486-35-9	Zinc Carbonate
292. 7646-85-7	Zinc Chloride
293. 557-21-1	Zinc Cyanide
294. 7783-49-3	Zinc Fluoride
295. 557-41-5	Zinc Formate
296. 7779-86-4	Zinc Hydrosulfite
297. 7779-88-6	Zinc Nitrate
298. 127-82-2	Zinc Phenolsulfonate
299. 1314-84-7	Zinc Phosphide
300. 16871-71-9	Zinc Silicofluoride
301. 7733-02-0	Zinc Sulfate
302. 13746-89-9	Zirconium Nitrate
303. 16923-95-8	Zirconium Potassium Fluoride
304. 14644-61-2	Zirconium Sulfate
305. 10026-11-6	Zirconium Tetrachloride

APPENDIX D

RECOMMENDED EQUIPMENT INVENTORY

PERSONNEL CLOTHING AND EQUIPMENT

Items of personal clothing and equipment listed below are issued to each member of the field investigation team. These items were designed to protect team members from the elements and from hazards associated with working in potentially dangerous environments:

- Boots (neoprene and safety with steel toe and shank),
- Coveralls (chemical-resistant, cotton),
- Ear plugs,
- Glasses (safety and prescription),
- Jacket (medium weight, and wind-breaker), and
- Rain suit.

Emergency Equipment

Emergency equipment is available in the field on a team basis in the event that it is needed. These items are always carried on vehicles used in onsite field investigations:

- Emergency Oxygen Administrator,
- Fire Extinguishers (assorted types and sizes),
- First-Aid Kit,
- Portable Eye/Face Wash Unit,
- Stretcher,
- Wool Blankets, and
- Wood Splints.

Respiratory Protection and Safety Equipment

Items of respiratory protection and safety equipment are maintained on field vehicles or, when necessary, in a controlled temperature environment and are issued as needed for onsite work. This equipment is critical to the welfare of team members working on hazardous substance sites and must be carefully maintained and inspected regularly:

- Air Escape Mask,
- Air-Purifying Respirator (with assorted cartridges or canisters),
- Air Tank Refill System,
- Butyl Rubber Apron,
- Butyl Rubber Booties,
- Butyl Rubber, Neoprene, or Viton Gloves,
- Chemical Protective Hood,
- Coveralls (disposable),
- Fully Encapsuling Suit (butyl rubber),
- Life Vests,
- Safety Harness (Swiss seat),
- Self-Contained Breathing Apparatus (with extra tanks), and
- Surgeon's Gloves.

Tools and Vehicular Equipment

The following items are included for their general utility in field situations:

- Booster Cables (12 ft),
- Bow Saw (30 in.),
- Broom,
- Curved-Back Wire Brush,
- Duckbill Snips (12 in.),
- Electrical Tape,

- Grounding Rod,
- Hacksaw (with blades),
- Hammer (Ballpeen, carpenter's, machinists's, and 4-lb sledge),
- Hatchet (13 in.),
- Hose (garden 50 ft or more with nozzle),
- Machete,
- Measuring Tape,
- Oil Spout,
- Paint (fluorescent),
- Pick (25 in. nonsparking),
- Pliers (8 in. diagonal cutting, 10 in. forged grooved joint, 8 in. lineman's, 8 in. long nose, and 8 in. slipjoint),
- Pocket Knife,
- Reflectors (safety warning),
- Rubber Mallet,
- Safety Flares,
- Screwdrivers (assorted),
- Shovel (D-handle, round point, nonsparking),
- Tire Pressure Gauge,
- Tool Box,
- Tow Chain (14 ft heavy duty),
- Truck Jack,
- Wooden Mallet,
- Wrecking Bar (nonsparking), and
- Wrenches, Nonsparking (10 in. adjustable, bung, 10 in. locking, 10 in. and 18 in. pipe, lug, and 6-piece combination set).

General Environmental Evaluation Equipment

The items listed below have uses related to the acquisition of data and samples for the basic characterization of a site.

Soil and Sediment Sampling Equipment--

- Aluminum Foil,
- Bucket Auger (3 in. with handle),
- Dredge,
- Labscoops (with handles),
- Plastic Jars (1 qt wide-mouth for metals),
- Posthole Digger,
- Split Spoon Sampler, 2 in. x 1.5 in. diameter, 24 in. x 18 in. length,
- Scoop (stainless steel),
- Shovel,
- Spatula (stainless steel, 8 in.), and
- Tape (Teflon).

Water Sampling Equipment--

- Automatic Dispenser (Pipetor),
- pH meter,
- Buffer Solutions (pH 4, pH 7 and pH 10),
- Container Brush,
- Conductivity Meter,
- Dissolved Oxygen Indicator (with probe for field use),
- Distilled Water,
- Hip Boots,
- Nansen-Style Bottles (water sampling with case),
- Plastic Beaker (1000 ml),

- Polyethylene Bags (8 in. x 12 in., 10 in. x 16 in., and 12 in. x 20 in.),
- Rope (nylon, 3/16 and 1/4 in.),
- Sampling Pump - Peristaltic,
- Stainless Steel Safety Lab Can,
- Thermometer (yellow, 20-1100),
- Tubing (Silicone for above peristaltic pump),
- Tubing (Teflon, 1/4 in.),
- Wash Bottles (500 ml),
- Water Bailer (Teflon or stainless steel),
- Water Level Indicator (electric or tape),
- Well Pump (submersible), and
- Whirlpak Bags (4.5 x 9).

Air Sampling Equipment--

- Personnel Sampling Pumps (with adsorbent tubes and/or fitters and impingers),
- Barometer Pressure Indicator,
- Carbon Absorption Tubes,
- Colorimetric Tubes (length-of-stain),
- Temperature Indicator, and
- Wind Speed Indicator.

Special Environmental Evaluation Equipment

The items listed below have uses related to the acquisition of data and samples for characterization of especially hazardous sites.

Ambient Site Characterization Equipment--

- Camera (35 mm and instant print),
- Passive Dosimeter/Samplers,
- Combustible Gas Indicator (with probe and calibrating test kit),

- Metal Detector,
- Oxygen Indicator,
- Photoionization Detector (Portable),
- Portable Gas Chromatograph,
- Radiation Dosimeter,
- Radiation Meter,
- Radiation Monitor (with audible alarm),
- Rangefinder,
- Resistivity Meter, and
- Surveying Equipment.

Hazardous Material Sampling Equipment--

- Brass Spoon (nonsparking),
- Drum Opener,
- Drum Sealer,
- pH Indicating Paper (wide and narrow range),
- Plastic Bags (assorted sizes with elastic closures; self-sealing not recommended),
- Plastic Sheeting,
- Stoppers (solid rubber, assorted sizes to fit tubing),
- Tongs (wooden, disposable),
- Tubing (glass, 4-ft lenghts, 17 mm ID with No. 1 1-hole stopper),
- Tubing (Polyethylene, 4 ft lengths; 6 mm to 20 mm ID), and
- Wooden Doweling (assorted lengths).

Support Equipment and Office Supplies

The following list contains equipment and supplies necessary for setting up and operating field command posts and decontamination areas:

- Sample Label Tags,
- Chain of Custody Forms,
- Bags (trash, plastic),
- Binoculars (wide angle 7 x 35),
- Buckets,
- Brown Wrapping Paper,
- Cellophane Tape,
- Chaining Pin Set,
- Clipboards,
- Clips (paper and alligator),
- Composition Book (numbered pages),
- Dairy Brush,
- Desk Stereoscope,
- Detergents,
- Engineer's Tape (12 ft),
- Extension Cord,
- Fiberglass Tape (lock type, open reel, 100 ft),
- Flagging Tape,
- Garbage Can (with top),
- Ground Plastic Sheets,
- Hand Calculator,
- Lantern (rechargeable),
- Level (hand, 2 X),
- Magnetic Hangers,
- Masking Tape (2 in. wide),
- Note Pads,

- Nylon Twine,
- Overhead Tarp (with rope and stakes),
- Pens, Pencils and Markers,
- Recorder (microcassette),
- Redwood Plugs (various sizes),
- Rope and Stakes (for cordoning off area),
- Rubber Bands,
- Scrub Brushes,
- Shower Curtain,
- Signs ("caution", "restricted area"),
- Sprayer (garden, 4-gallon),
- Stapler (heavy duty),
- Wash Tubs,
- Water Jugs (collapsible 5-gallon), and
- Wheelbarrow.

Shipping Supplies and Labels

Listed below are items used in the shipment of samples and equipment. Such shipments are carefully regulated by the U.S. Department of Transportation and must be prepared in accordance with DOT requirements to avoid legal penalties. U.S. Environmental Agency sample chain-of-custody provisions must also be kept in mind.

The reference for DOT specifications for shipping is the 49 CFR, particularly 172.101. The Bureau of Explosives Tariff No. BOE-6000 may also be consulted:

- Air Bills,
- Dry Ice (or water ice),
- Electrical Tape,
- Evidence Tape,
- Fiberglass Tape (1-in. and 2-in.),

- Foam Rubber,
- Garbage Bags,
- Ice Coolers (48 qt or 20 gallons), and
- Labels
  - Corrosive
  - Danger - Peligro
  - Dangerous When Wet
  - Empty
  - Explosive A, B and C
  - Flammable Gas
  - Flammable Liquid
  - Flammable Liquid N.O.S.
  - Flammable Solid
  - Flammable Solid N.O.S.
  - Hydrogen
  - Irritant
  - Limited Quantity
  - Limited Quantity (731 or higher)
  - Organic Peroxide
  - ORMA Dry Ice
  - Oxidizer
  - Poison
  - Poison A
  - Poison B
  - Poison Gas
  - Poison Liquid N.O.S.

  - Radioactivity I, II and III
  - This End Up
- Masking Tape (2 in.),
- Metal Paint cans (half gallon or gallon with lid and sealing clips),
- Official Sample Seal (U.S. EPA) (EPA Form 7500-2, R7-75),
- Rubber Stopper (size 000, solid; for cooler drain),
- Shipper's Certification for Restricted Articles, and
- Vermiculite.

APPENDIX E

FIELD CHARACTERIZATION OF HAZARDOUS WASTE

One of the primary objectives of a hazardous waste site investigation is to thoroughly determine the hazards and risks associated with the wastes. Before such an assessment can be accomplished, the composition of the wastes and the hazardous properties that the wastes exhibit must be determined. In past years, much of the emphasis in environmental analytical chemistry has been directed toward reducing the detection limits for contaminants. Only recently has attention been focused on activities where it becomes important to have the ability to characterize and analyze chemical wastes present in concentrated form as is commonly found at hazardous waste sites. Many of the procedures designed for the analysis of low level environmental samples cannot be directly applied to the analysis of concentrated samples. Therefore, new analytical procedures are being developed and current methods are being modified to adapt to the needs of hazardous waste analysis.

Field characterization procedures which allow investigators to rapidly screen, classify, and segregate unknown wastes are examples of techniques which have been specifically developed with these needs in mind. Their purpose is to provide immediate data which will allow onsite personnel to make decisions regarding segregation of incompatible wastes, hazard potential, safety precautions and future analytical needs. The procedures utilize portable instrumentation and equipment. The procedures also employ analyses which are simple to perform, and they allow for rapid sample throughput even under extreme conditions. Two such procedures have been developed within the U.S. Environmental Protection Agency, one through Region VII's Emergency Planning and Response Branch in Kansas City, Kansas, and a second through the Environmental Response Team in Edison, New Jersey. Although both procedures have similarities, there are enough differences in technique and application to warrant presentation of both. Basically the former procedure is completely field oriented and is designed for screening a small number of samples at a time. The latter technique uses instrumentation and equipment requiring a "field laboratory" type environment, and permits rapid screening of large numbers of samples. Both techniques are useful in their own right, and it is up to the investigator to determine which procedure (or combination of procedures) is best suited for his/her application.

Region VII Field Characterization Procedure

General--

In an effort to strengthen the capabilities of field investigation teams, this field characterization procedure has been developed to enable personnel to characterize hazardous substances at the time of sampling. The characterization process allows for incompatible wastes to be segregated and compatible samples to be composited for more cost effective laboratory analysis. The field characterization procedure is designed to interface with laboratory procedures such as those being developed in Volume III. The information provided by the field tests will help laboratory personnel determine the safety precautions necessary to handle a sample, as well as to determine the additional analytical needs.

The specific tests and characterization format discussed in this section are designed to be used in a field investigation capacity, where fewer than 25 samples will be collected for characterization in a given day. The characterization kit is fully self-contained with the exception of support equipment such as a radiation meter, an organic vapor detector, and personal protective equipment. A prototype test kit has been designed and consists of the equipment listed in Table E-1 and the support equipment listed in Table E-2.

Safety Considerations--

There are numerous safety considerations which must be addressed before collecting a hazardous waste sample and conducting this characterization procedure. Although a detailed discussion of safety measures to be followed is not within the scope of this section, some general comments are warranted at this time. Refer to Section 3 of this document and Volume IV for a detailed treatment on the subject of safety. In general, the greatest risk to field personnel exists from the time a closed container is opened to obtain a sample, until the waste has been sufficiently characterized to assess its acute hazards.

All tests in this field characterization scheme are to be conducted in a noncontaminated area on the upwind side of the site. The level of personal protection may vary from site to site, but the level of protection in the characterization area should always be equal to or better than the protection worn in the sampling area. Respiratory protection is mandatory throughout the characterization procedure. All contaminated sampling and characterization materials, as well as protective gear, must be decontaminated or disposed of properly. Some additional safety considerations, unique to specific tests, will be addressed later in the procedure narrative.

Procedural Background--

The field hazardous waste characterization procedure is divided into several parts, beginning with a site characterization section and proceeding into sample acquisition and characterization of the wastes. Water soluble liquids, water insoluble liquids, and solids are characterized in separate sections of the procedure. This separation is made in order to allow the tests in a section to be geared towards the characteristics of the waste which will be placed in that section. For instance, solids and liquids will require different manipulation in order to perform the tests in the procedure, and water soluble and insoluble wastes do not require all of the same characterization tests.

The tests included in this procedure have been restricted to those which provide pertinent information on general physical and chemical properties, waste compatibilities, and acute safety or toxicity hazards. It is not possible to design a sample characterization procedure which always can provide the

TABLE E-1. CHARACTERIZATION KIT INVENTORY

Item	Approximate price
absorbant pads	5.00/package
bunsen burner	14.50/each
chemicals	
acetic acid	8.00/500 ml
cadmium nitrate	15.00/100g
sodium acetate	10.00/500g
sodium hydroxide	4.00/100g
sulfuric acid	8.00/500 ml
copper wire, 20 gauge	2.00/roll
cyanide detector tubes (Matheson/Kitagawa)	15.00/package of 10
cubitainers, 1 liter	.50/each
forceps	3.00/each
gloves	3.00/each
viton	26.00/pair
PVC disposable	10.00/package of 100
labels	5.00/package of 1000
lead acetate paper (Fisher)	7.00/box of 2000
pencils & paper	1.00
peroxide indicator strips (EM Quant, Sargent-Welch)	10.00/package of 100
pH paper	
full range strips (J. T. Baker)	5.00/roll
full range kit (Fisher)	12.00/box
pipettes, disposable	
2 ml	20.00/package of 100
5 ml	20.00/package of 100
10 ml	20.00/package of 100
transfer	20.00/package of 1000
pipette fillers	
automatic	18.00/each
small	1.00/each
plastic bags	
large	10.00/package of 50
small	5.00/package of 50
potassium iodide/starch paper (Fisher)	7.00/box of 2800
propane tank	9.00/each
spatulas	
porcelain (Coors)	8.00/each
stainless steel, large	5.00/each
stainless steel, small	4.00/each
specimen beakers	25.00/case of 500
tackle box (UMCO 2080 UPB)	65.00/each
tape, transparent	1.00/roll
test tube racks	15.00/each
thermometer	7.00/each
vials, 40 ml with septas	60.00/box of 100
water, distilled	1.00/gallon
wipers, disposable	2.00/box
TOTAL	$489.00

NOTE: Manufacturers or suppliers are not listed on items readily available from most chemical or scientific suppliers.

TABLE E-2. SUPPORT EQUIPMENT

Item	Approximate Price
Combustible gas indicator (MSA)	$600.00
Fire extinguisher	$50.00
Gas detector kit (MSA, Draeger, Matheson)	$300.00
Organic Vapor Analyzer - GC (Analabs)	$5,000.00
Personal protective equipment	$200.00-2,000.00
Photoionization detector (HNu Systems)	$3,500.00
Radiation meter	$400.00
Total	$10,050.00 - $11,850.00

information desired about every type of waste that might be encountered; therefore, it is advisable to consider adding further tests or omitting tests in order to satisfy the objectives of the waste characterization at each individual site.

The procedure is designed to permit compatible wastes to be placed into categories for composite analysis when desired and allow incompatible wastes to be separated. Some typical waste categories are listed below:

- air reactive wastes
- compatible solids,
- cyanides and sulfides,
- inorganic acids,
- inorganic bases and neutrals,
- inorganic oxidizers,
- organic oxidizers,
- organic acids,
- organic bases and neutrals, and
- radioactive wastes.

Few sites will contain wastes from all of the above categories, while some sites may require the addition of other categories such as gas cylinders or explosive wastes. In any event, all information must be properly documented using data sheets similiar to that listed in Figure E-1.

Sample Number:____________ **Ambient Temperature:**____________

Type of Container Collected From:____________

Markings on the Container:____________

____

Air Reactive: Pos.______ **Neg.**______ **Radioactive: Pos.**______ **Neg.**______

Liquid______ **Solid**______ **Other (Specify)**____________

Appearance of Waste:____________

OVA or Hnu Reading:____________ **(attach chromatogram if applicable)**

Ignitability (explain results)____________

____________**Beilstein's Halogen Test: Pos.**______ **Neg.**______

Waste/water mixture (determine water reactivity, record liquids as soluble or insoluble in water, estimate the percent solubility of solids):

____

____

pH determination:____________

Oxidizer Test: Pos.______ **Neg.**______ **Peroxide Test: Pos.**______ **Neg.**______

Sulfide Test: Pos.______ **Neg.**______ **Cyanide Test: Pos.**______ **Neg.**______

Comments:____________

____

____

____

____

____

____

____

Figure E-1. Hazardous waste characterization data sheet.

Site Entry and Safety Characterization--

Site entry procedures will vary on a case-by-case basis depending on the nature of the site and how much is known about the site initially. Conservative levels of protection should always be used until sufficient information is obtained to deem the precautions unnecessary.

Several indispensable monitoring and survey instruments used in this protocol are: an explosive atmosphere meter, an oxygen meter, a hand held gas detection pump with hydrogen cyanide detector tubes, a radiation survey meter and a portable flame ionization detector or photoionization detector for measuring organic vapor concentrations. Additional survey equipment (such as a metal detector or additional gas detector tubes) may be necessary depending on particular sites.

The organic vapor monitors discussed in this section are the Analabs Organic Vapor Analyzer (OVA) and the HNu photoionization detector (HNu). The OVA may be equipped with a gas chromatograph (GC) option for added field analysis capabilities. The HNu is a versatile, low maintenance monitoring instrument. One must remember, however, that this instrument does not detect several flammable hydrocarbons, such as methane, ethane, and propane. Whenever the vapor concentrations are above full scale for these instruments, a less sensitive explosion meter must be employed. Volume II--Available Sampling Methods--provides details for the use of these instruments.

Visual Site Assessment--

The steps in this characterization phase are very broad and will differ greatly from site to site. All pertinent meteorological information and geological characteristics should be recorded. A complete inventory of the site may be conducted including the types and quantity of containers present. Any customized containers or suspicious looking drums should be noted for special handling and segregation. Evidence which indicates the toxicity of the waste or potential hazards, such as dead plants and animals or bulging drums should be recorded.

Sample Aquisition--

Great care is required when opening drums or any sealed container. Any drum opening procedure should include some method for manually or mechanically checking for shock sensitive wastes from a safe distance, before a drum is opened to collect a sample. Separate samples should be collected for field characterization and laboratory analysis. A maximum of 15 milliliters (ml) of waste is needed for field characterization tests in this procedure.

Air Reactivity--The readily air reactive wastes should be discovered during the opening or sampling procedure. The air reactive substances normally require special packaging. The wastes may be stored under water or some other liquid to prohibit air from coming in contact with the waste. They may also be found in sealed ampules, corregated drums, stainless steel cannisters, or specially lined drums. Some chemicals such as white phosphorus or barium azide react with the oxygen in the air. While others such as cesium or various metal hydrides react with the moisture in the air (Windholz, 1976). Many of the air reactive chemicals are explosive.

There may be drums containing various amounts of laboratory chemicals (lab-packs). Lab-packs will have removable lids and often contain chemicals which are incompatible. Any specialized or suspicious looking containers require special handling and should be suspected of containing reactive or explosive wastes. Gas cylinders may be encountered and should be considered for sampling or destruction on a case-by-case basis depending on the condition of the cylinders and the suspected contents.

Radioactivity--Once the waste is found to be compatible with the ambient atmosphere, it is checked for radioactivity with a radiation survey meter.

Physical State--Much of the initial characterization is performed in conjunction with the sampling operation. Determine if the waste is a liquid, solid, semi-solid, or heterogeneous mixture. This determination may be somewhat arbitrary for some very viscous liquids or resins, but it is not crucial because the same characterization tests are performed on both solids and liquids. If the waste is a heterogeneous mixture, the solid and liquid phases may be separated for characterization. Any observable characteristics of the waste should be noted at this time. From this point, the liquids and solids are characterized separately.

General Liquid Characterization--

The remainder of the waste characterization tests are to be performed at a safe distance from the sampling area, in a noncontaminated area, but within the decontamination line. The tests are to be performed on a portable table or bench covered with plastic. The flame tests discussed below must be performed in a separate location to minimize the chances of an accidental fire.

Immiscible Liquid Phases--Liquids are usually sampled with a "thieving rod" or a similar pipette type instrument. The sample may be examined through the glass rod for immiscible phases or other visual differences. If more than one phase are present, they should be separated for individual analysis. Often, if more than one phase are present, one will be aqueous.

Flame Tests--The apparatus for the flame tests consists of a bunsen burner fueled by a propane tank (Figure E-2). An inline pressure bleed assembly should be added to prevent a dangerous pressure buildup in a rubber tubing. This may be accomplished by placing a Tee-joint in the line and running a tube from the Tee into a flask of heavy oil or other low flammability viscous liquid. This will allow excess propane to bubble into the liquid before much pressure can build up in the tubing. The flame height must be adjusted with the propane tank valve rather than the bunsen burner adjustment in order to prevent a continual loss of propane. It may be necessary to construct a windbreak with coolers or other nonflammable objects. A fire extinguisher should always be kept close by when conducting these characterization tests.

The first flame characterization test to perform is a crude flammability test with the waste. One or two drops of the waste are placed in a porcelain spoon and held above the flame of a bunsen burner fueled by a portable propane tank. The ignitability should be recorded as well as any other observations such as flame color or sootiness. An indication of the composition of the waste may be obtained from these observations. For instance, aromatic compounds

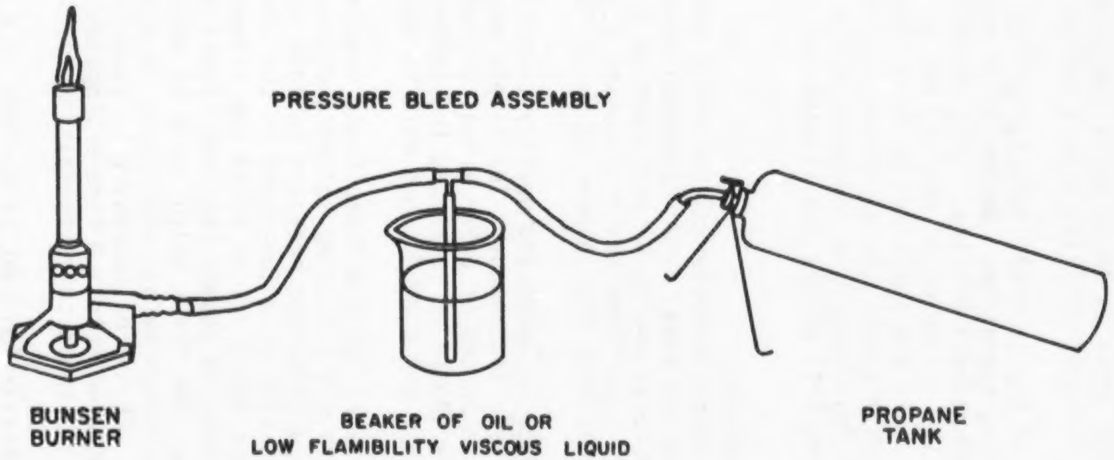

Figure E-2. Flame test apparatus.

generally produce a yellow sooty flame. If 110V current is available, a more accurate flammability test could be performed with a Setaflash or comparable flash point tester.

The Beilstein's halogen test is also conducted at this time. A small two- or three-looped coil is made in the end of a piece of 20 gauge copper wire. The coil is held in the edge of the flame until any green flame disappears. Next, the wire coil is allowed to cool and then dipped into the waste and returned to the flame. A green flame will indicate the presence of a halogen (chlorine, bromine or iodine). Fluorine does not produce a positive result. The green flame will usually appear shortly after the bulk of the waste has burned off of the coil. This test is surprisingly sensitive and is important for identifying the presence of halogenated organics such as polychlorinated biphenyls (PCBs) or chlorinated solvents. Under ideal conditions, PCBs have been detected at concentrations below 200 mg/kg by this method. However, this is not below the 50 mg/kg EPA action level for PCB disposal; therefore, a negative result on this test does not rule out the need for laboratory screening for halogenated organics.

There are several factors which may interfere with the Beilstein test. Very volatile liquids may have a tendency to evaporate in the flame before decomposition can occur, thereby producing a negative result. Several non-halogenated compounds have been stated to also cause a green flame, such as organic acids, copper cyanide, urea, and quinoline and pyridine derivatives (Shriner, 1964).

Water Reactivity and Solubility--Place approximately 1 ml of the sample in a 40 ml glass vial, plastic specimen beaker, or similar flask, and carefully add 1 ml of distilled water while monitoring the temperature of the mixture. A large temperature change, gas generation, ignition, or color change are all indications of water reactivity and should be recorded as such. Slight temperature changes indicate heats of solution and should not be attributed to water reactivity.

Determine if the liquid is soluble or insoluble in water. A waste which is soluble in water will be considered inorganic and characterized more completely in the next section, Inorganic Liquid Characterization. A waste which is not readily soluble in water will be characterized using procedures in the section entitled Organic Liquid Characterization. Some organic solvents such as acetone and alcohols are miscible with water but the mixing reaction that occurs is usually easily detectable.

If the liquid is not soluble in water, record whether it is denser or lighter than water. This can be an indication of the wastes composition, as most halogenated organics are heavier than water and most hydrocarbons are less dense than water.

Inorganic Liquid Characterization--

Headspace Check--Check for the presence of water soluble volatile organics in the waste by testing the headspace above the sample with an OVA or HNu. If vapors are detected, further organic analysis in the laboratory or with the GC mode of the OVA is advisable.

pH Determination--Test papers were selected as the method of pH determination for this procedure. The pH paper was chosen preferable to a more sensitive pH meter because of the size, probe contamination problems, and long term reliability problems associated with a pH meter.

To measure the pH, either immerse a portion of a strip of indicator paper into the sample, or place a drop of the waste onto the paper. If the waste is colored or dark and stains the paper, the desired pH color change can be seen at the margin of the stained area or on the reverse side of the spot. For the purposes of this characterization procedure, a pH of less than 3 is considered acidic, a pH greater than or equal to 3 but less than or equal to 10 is termed neutral, and a pH greater than 10 is considered basic.

Oxidizers and Peroxides--Strong inorganic oxidizers are detected with potassium iodide (KI)/starch paper. Place a drop of the waste on a strip of dry KI/starch paper and another drop on a strip of KI/starch paper which has been previously moistened with buffer solution. [Buffer Solution: Dissolve 24.3 g of sodium bicarbonate ($NaC_2H_3C_2.3H_2O$) or 14.6 g of anhydrous sodium bicarbonate ($NaC_2H_3O_3$) in 40 mls distilled water. Add 48 mls of concentrated acetic acid and bring solution to 100 ml with distilled water.] The development of a purple to black stain on either strip indicates the presence of an oxidizer. If the waste is dark and stains the paper due to its color, check for the oxidizer stain around the perimeter of the spot or on the reverse side of the indicator paper as was done with the pH paper.

An alternative method for detecting oxidizers is by measuring the oxidation-reduction potential of a waste solution through the use of a pH-conductivity meter (Turpin, 1981). This is a very sensitive method and may be considered for use when a large number of samples are to be characterized and where electricity will be available. A modified version of this procedure can be found under the heading, Emergency Response Team Waste Compatibility Test Procedure (Modified), later in this section.

When possible, peroxides in the aqueous solution are detected with EM-Quant Peroxide Test Strips. Often the waste is too dark to allow this test to be performed reliably, but it can provide useful information when employable. To perform the test, adjust the pH of 1 milliliter (ml) of the sample to between a pH of 2 and 12 with sodium hydroxide (1.0N) or sulfuric acid (4:1) solutions. Next, immerse the reagent portion of the strip in the sample for 5 seconds. Remove the strip from the sample and observe the reagent pad for the formation of a blue stain. The test is sensitive to a few parts per million and the boldness of the blue stain is representative of the concentration.

Cyanides and Sulfides--The neutral and basic liquids are now tested for the presence of sulfide or cyanide ions. To test for sulfide, place a drop of the sample on a strip of dry lead acetate paper and a drop on another strip pre-moistened with buffer solution. A black stain on either strip indicates the presence of sulfide. If the sulfide test is positive, the sulfide should be removed before the following cyanide test is conducted. This may be be removed before the following cyanide test is conducted. This may be accomplished by adding cadmium nitrate to a small amount of the sample and swirling the mixture to precipitate cadmium sulfide. As a check on sulfide removal, alternate adding small amounts of cadmium nitrate and repeating the spot test until the test is negative.

The first cyanide test discussed is conducted through the use of Matheson-Kitigawa Cyanide Ion Detector tubes. High chloride ion concentrations may interfere with the detector tube test, therefore the waste is diluted by adding 8 mls of distilled water to a 0.5 ml sample. This should dilute the sample to where effects from the interfering ions are minimal and the test is still sensitive to less than 100 mg/l cyanide. After diluting the sample, score and break the tips off of a Matheson-Kitigawa Cyanide Ion Detector tube and set it in the sample. Allow the liquid to rise into the column by capillary action and observe any color change in the tube. A deep blue color will indicate the presence of the cyanide ion.

An alternative spot test method for detecting cyanide amenable to chlorination and cyanogen chlorides (CNCl) is discussed in Standard Methods for the Examination of Water and Wastewater (American Public Health Association et al., 1980). The procedure may be modified to facilitate screening concentrated waste solutions rather than environmental samples for which the procedure was designed.

A third alternative method for detecting sulfide or cyanide containing wastes consists of using a Draeger or comparable gas detector pump and hydrogen sulfide and hydrogen cyanide detector tubes. The detector tubes which are chosen should contain reagents to remove interfering compounds. One or two drops of sulfuric acid solution (4:1) is added to an equally small amount of sample in a vial and the vapor space above the mixture is immediately tested for H_2S and HCN. If both tests are negative, several more drops of sample and acid solution are added and the test is repeated. The detector tubes may be reused several times if the test results continue to be negative. Due to the high toxicity or H_2S and HCN, precautions must be taken to avoid breathing any gases which may evolve from the sample.

Inorganic Liquid Laboratory Analysis--The nonreactive wastes which exhibit like properties as shown by the previous tests may be composited for further laboratory analysis when desired. Caution must be exercised when compositing samples and close observation is necessary to detect any reactions between the wastes.

The laboratory analysis of the water soluble liquids will vary depending on the results of the field tests and what analytical equipment is available to the laboratory. Preliminary tests could include total dissolved solids and total organic carbon (TOC), followed by more detailed cation and anion analysis. The TOC procedure may show that additional organic analysis is necessary. Tests specified in the Resource Conservation Recovery Act regulations, such as EP, toxicity, or corrosivity may also be conducted (U.S. Environmental Protection Agency, 1980).

Organic Liquid Characterization--

Headspace Check--A majority of the liquid organic wastes encountered at a disposal site will contain volatile solvents or other volatile organics as a significant portion of their volume. These chemicals are usually readily detectable in the headspace above the sample with an OVA, HNu or other vapor detection instrument. The concentration of the vapors above the waste is recorded along with temperature of the sample at the time of the reading. An experienced analyst, equipped with a GC-modified OVA or other portable GC and standards of common solvents can further characterize the vapors and often identify the major volatile components of the wastes. If there are no detectable vapors above the waste, it can be assumed to consist of nonvolatile organics. For instance, PCB oils may not contain any volatile components.

Organic Oxidizers and Peroxides--Check for water insoluble oxidizers by placing a drop of the waste on a strip of dry KI/starch paper and a drop on a strip pre-moistened with buffer solution. A purple to black stain on either strip indicates a strong oxidizer.

The organic peroxide test is performed with EM-Quant peroxide test strips. This test can only be performed on relatively clear liquids. After immersing the reagent portion of the strip in the sample for five seconds, the strip must be moistened by breathing several times on the reagent pad. When a respirator is worn this may be accomplished by holding the strip below the exhalation valve of the mask. Peroxides are indicated by a blue stain as in the inorganic liquid test.

pH Determination--A pH value is obtained for organic liquids by adding 1 ml of deionized water to 1 ml of the sample, mixing, allowing to separate, and determining the pH of the water phase. The pH range for such solutions will not be nearly as wide as for water-soluble wastes; therefore, to detect small differences in pH values, accuracy in the pH determinations is important. Cutoff limits to designate the wastes as organic acids, neutrals, or bases cannot be prestated in this procedure, because such designations would vary depending on the range of pH differences, on the pH of the deionized water before it is added to the waste, and on the relative distribution of the pH values of other samples tested from the site.

Organic Laboratory Analysis--Water insoluble wastes with similar properties may be composited for laboratory analysis. Care must be taken to avoid compositing unlike or incompatible wastes. The Beilstein positive and negative wastes should not be mixed, in order to prevent the contamination of non-halogenated organics with PCBs or other unwanted halogenated wastes.

Preliminary laboratory sample cleanup and analysis may include resin column cleanup, thin layer chromatography, or an infrared scan. The heat value, specific gravity, and sulfur content of the sample will need to be determined if wastes are being considered for disposal by incinerator. More detailed volatile, base/neutral, acid, and pesticide analyses are possible by gas chromotography/mass spectrometry (GC/MS), high performance liquid chromatography (HPLC) or GC procedures. Alternative or additional analytical techniques may be used in the laboratory depending on what additional information is needed and the available laboratory facilities.

Solids Characterization--

Physical Characteristics--Often information will be evident about the hazards of a waste by the way it is packaged and its physical characteristics such as texture, color and density. If a waste is packaged to exclude water, as in plastic lined or water tight containers, it should be treated as a water reactive waste until proven otherwise. Conversely, if a waste is moist or contains water, it should not be allowed to dry out until sufficient tests have been conducted to show that it is not explosive when dry. Record any visual observations of the waste before proceeding into the characterization procedure.

Headspace Check--Check for the presence of volatile organics in the waste by testing the headspace above the sample with an OVA or HNu and record any readings.

Flame Tests--The bunsen burner ignitability test discussed in General Liquid Characterization is also performed on solids. Place a very small sample of the waste on a porcelain spatula and hold it in the edge of the flame. Record all observations, such as flammability, flame color, the amount and color of residue left after burning, etc.

The Beilstein's copper wire halogen test is conducted at this time if the consistency of the waste is such that it will adhere to the coil of copper wire. Remember to hold the wire in the flame until the green flame disappears before repeating the test with the waste on the coil.

Water Tests--There often will be sufficient moisture in the waste to conduct some of the water dependent tests before water is added to the waste. Try to get a pH determination by pressing the pH strip onto the waste with a blunt instrument. If sufficient moisture is present, the water will soak into the strip and the pH reading can be taken on the side of the strip which did not come in direct contact with the sample. If the pH test is successful, the oxidizer test may be performed in the same manner. Apply a dry strip and a buffer solution moistened strip of KI/starch paper to the waste and check for the development of a purple to black stain on the strips. A stain on either strip indicates a strong oxidizer.

After the pH and oxidizer tests are attempted, carefully add approximately 1 ml of distilled water to 1 cubic centimeter of sample while monitoring the temperature. Record any temperature change or signs of water reactivity such as gas generation, violent churning, etc. Roughly estimate the percentage solubility of the waste in water.

If the pH and oxidizer tests were unsuccessful on the dry solid, these tests may be conducted on the waste/water mixture by the methods described for inorganic liquids. The peroxide test will nearly always be impossible to perform on the mixture due to the color of the solution.

Sulfides and cyanides can be detected in the waste/water mixture by one or more of the methods described for use on inorganic liquids.

Solids Laboratory Analysis--The solid samples which exhibit similar properties in the test results and have similar appearance and consistency may be composited for laboratory analysis. The lab analysis should begin with determinations of percent moisture and percent volatile solids, followed by further inorganic and organic analysis as deemed necessary.

Characterization Procedure Summary--

Procedure Flow Diagram--A flow diagram outlining the major points in the field characterization tests is shown in Figure E-3.

Site Entry and Safety Characterization--All background information about the site is collected prior to site entry. Maximum personal protection is worn during the initial site characterization.

- Determine the percent of the lower explosive limit (LEL) of vapors in the atmosphere with a combustible gas indicator while continually monitoring the oxygen level.
- Test for hydrogen cyanide with a Draeger pump and tubes.
- Test for radioactivity with a survey meter.
- Continually monitor with an organic vapor analyzer or photoionization detector.

Visual Site Assessment--

- Record the air temperature and other pertinent meteorological information and geological characteristics.
- State of containers (corrosion, bulging drums, etc.).
- Other nonspecific information (dead plants or animals, vegetation stress, labels on drums, etc.).

Sample Aquisition--Drum opening techniques and safety measures are not within the scope of this procedure.

- Air Reactivity
  - Determine if the waste is air reactive.
- Radioactivity
  - Test individual wastes for radioactivity.
- Physical State

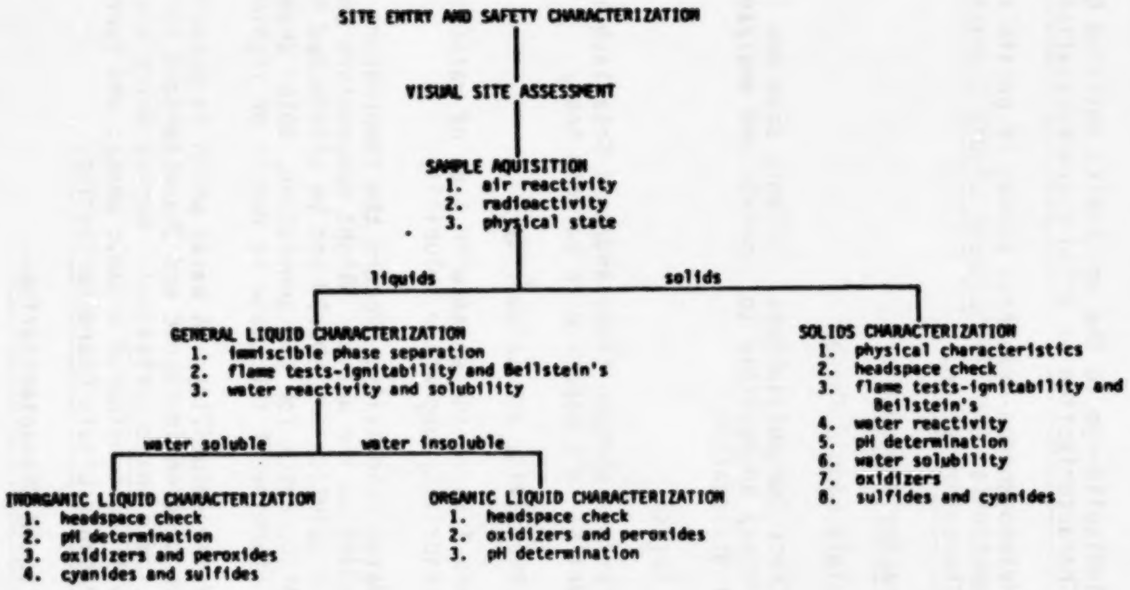
SITE ENTRY AND SAFETY CHARACTERIZATION
VISUAL SITE ASSESSMENT
SAMPLE AQUISITION
1. air reactivity
2. radioactivity
3. physical state
liquids
solids
GENERAL LIQUID CHARACTERIZATION
1. immiscible phase separation
2. flame tests-ignitability and Beilstein's
3. water reactivity and solubility
SOLIDS CHARACTERIZATION
1. physical characteristics
2. headspace check
3. flame tests-ignitability and Beilstein's
4. water reactivity
5. pH determination
6. water solubility
7. oxidizers
8. sulfides and cyanides
water soluble
water insoluble
INORGANIC LIQUID CHARACTERIZATION
1. headspace check
2. pH determination
3. oxidizers and peroxides
4. cyanides and sulfides
ORGANIC LIQUID CHARACTERIZATION
1. headspace check
2. oxidizers and peroxides
3. pH determination

Figure E-3. Flow diagram of the field characterization tests.

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- Determine if it is a liquid, solid, semisolid, or heterogeneous mixture.

1. Liquid--go to the section entitled General Liquid Characterization.

2. Solid--go to the section entitled Solid Characterization.

3. Semisolid--go to the section(s) entitled General Liquid Characterization or Solid Characterization.

4. Heterogeneous--separate phases if possible and go to the section(s) entitled General Liquid Characterization or Solids Characterization.

Liquid Characterization--

- Immiscible Liquid Phases

  - Check for multiphases. If more than one liquid phase is present, it may be possible to separate and analyze the phases individually.

- Flame Tests

  - Perform an open flame and/or a Setaflash ignitability test and Beilstein's copper wire halogen test.

- Water Reactivity and Solubility

  - Mix 1 ml of the waste with 1 ml of water to check for water reactivity and water solubility.

  1. Water reactivity: Record the temperature change when water is added to the waste. Slight temperature changes indicate heats of solution and should not be attributed to water reactivity. Also, check for gas generation, color change, combustion, and determine if the waste is denser or lighter than water.

  2. Water solubility: A waste which is soluble in water will be considered inorganic and characterized further in Inorganic Liquid Characterization. Wastes which are insoluble in water will be considered organic wastes and further characterized in Organic Liquid Characterization.

Inorganic Liquid Characterization--

- Headspace Check

  - Check for the presence of soluble volatile organics with an OVA or HNu. If volatiles are present, further organic analysis in the lab or with the gas chromatograph (GC) mode of OVA may be necessary.

- pH Determination
  - Determine the pH of the waste with pH paper
    1. pH <3 - acidic
    2. pH $\geq$3 and $\leq$10 - neutral
    3. pH >10 - basic
- Oxidizers and Peroxides
  - Check for inorganic oxidizers with potassium iodide (KI)/starch paper and peroxides with peroxide indicator strips.
- Cyanides and Sulfides
  - Check for sulfides and cyanides (several methods are discussed).
- Inorganic Liquid Laboratory Analysis
  - Wastes with similar characteristics may be composited for laboratory analysis.
    1. Total dissolved solids and total organic carbon.
    2. Cation and anion analysis.
    3. Organic analysis if necessary.

Organic Liquid Characterization--

- Headspace Check
  - Check for the presence of volatile organics with an OVA or HNu. If present, further volatile organics analysis with the GC mode of the OVA may be desirable. If absent, the waste consists of heavier nonvolatile organics.
- Organic Oxidizers and Peroxides
  - Check for an organic oxidizer with KI/starch paper and peroxides with peroxide indicator paper.
- pH Determination
  - Check the pH of a deionized water shakedown of the organic.
- Organic Laboratory Analysis

- The wastes of the separate organic groups may be composited with the exception of some viscous wastes.
    1. Infrared analysis for determining molecular structural features.
    2. Volatiles, base/neutrals, acids, pesticides by GC/MS and GC.

Solids Characterization--

- Physical Characteristics
    - Record color, texture, density, etc.
- Headspace Check
    - Check for the presence of volatile organics above the waste with an OVA or HNu.
- Flame Tests
    - Perform the open flame ignitability test and Beilstein's copper wire halogen test if possible.
- Water Tests
    - Carefully mix approximately 1 cubic centimeter of waste with 1 milliliter of distilled water.
        1. Check the water reactivity parameters discussed during Liquid Characterization.
        2. Determine the pH of the waste/water mixture.
        3. Roughly estimate the solubility of the waste in water.
        4. Check for oxidizers with KI/starch paper.
        5. Check for sulfides and cyanides.
- Solids Laboratory Analysis
    - Solids with similar properties may be composited
        1. Percent moisture and percent volatile solids.
        2. Inorganic and organic analysis as deemed necessary.

References--

1. American Public Health Association, American Water Works Association, Water Pollution Control Federation. "Standard Methods for the Examination of Water and Wastewater", 15th Edition. American Public Health Association, Washington, D.C. 1980.

2. Christian, G. D. "Analytical Chemistry", 2nd Edition. John Wiley and Sons, New York, NY. 1977.

3. Shriner, R. L., R. C. Fuson and D. Y. Curtin. "The Systematic Identification of Organic Compounds", 5th Edition. John Wiley and Sons, New York. 1964.

4. Turpin, R. D. and V. Frank. "Oxidation Reduction Field Test for Use at Hazardous Material Spills". U.S. Environmental Protection Agency, Environmental Response Team, Edison, N.J. 1981.

5. U.S. Environmental Protection Agency, Waste Characterization Branch, Office of Solid Waste. "Test Methods for Evaluating Solid Waste: Physical/ Chemical Method", Office of Water and Waste Management, Washington, D.C. 1980.

6. Windholz, M., S. Budavari, L. Y. Stroumtsos and M. N. Fertig, ed. "The Merck Index", 9th Edition, Mench and Company, Inc. Rahway, N.J. 1976.

Emergency Response Team Waste Compatibility Test Procedure (Modified)

Overall Characterization Scheme--

Collected samples will be characterized by following the scheme shown in Figure E-4 and by using the procedures given in this section. The physical description of the sample is a visual observation of color, physical state, viscosity, number of phases, etc., in the sample and does not have a written procedure. Careful records will be kept for each sample as it is tested. An Analytical Report Sheet is shown in Figure E-5.

Safety is the prime consideration in characterizing the samples; efficient handling to process the maximum number of samples is also important. To accomplish both of these goals, it is recommended that analyses be conducted in a "field laboratory" type environment located outside of the hot zone perimeter. This can be a completely equipped mobile laboratory or a makeshift arrangement set up specifically for the task at hand; in any event it should be organized and arranged in such a way as to simulate a laboratory atmosphere. Work stations should be assigned and organized to specific tasks, electrical power conveniently located and adequate ventilation in the form of hoods or fans made available.

Radiation Monitoring--

Determine if the waste is radioactive by (1) screening drums as soon as possible after staging and opening, or (2) screening samples as soon as received. The available instrument is generally a gamma survey instrument which indicates

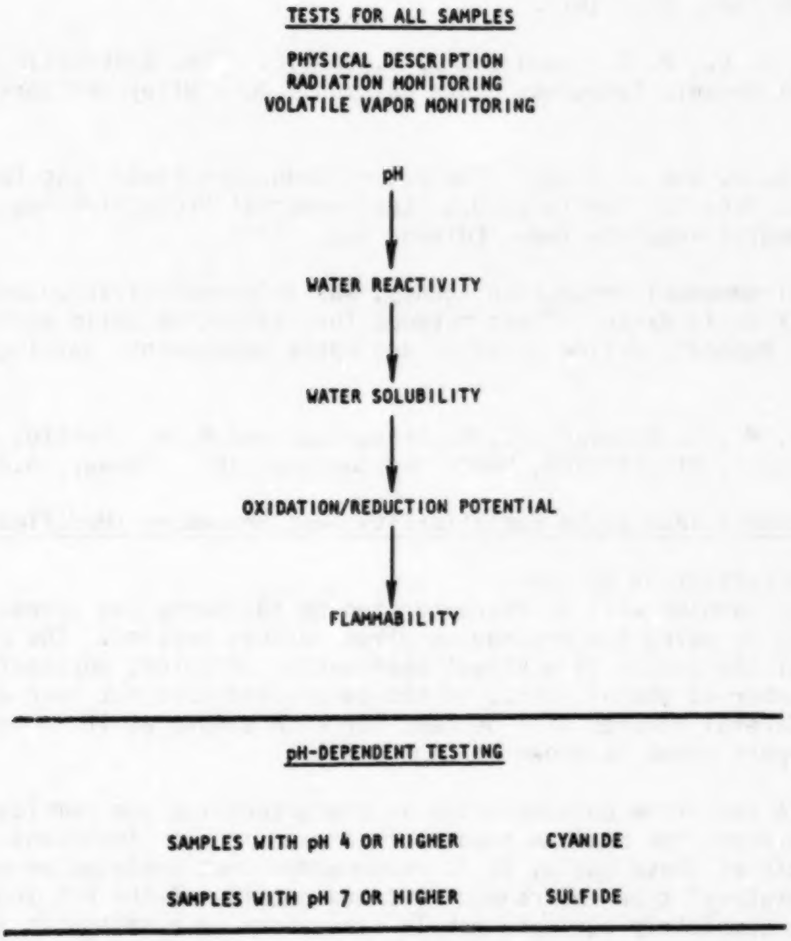

Figure E-4. Test sequence for characterizing hazardous wastes.

ANALYTICAL REPORT SHEET

Analyst ____________

Date ____________

Sample/Drum No. ____________

Water Reactivity **Nonreactive** ____________ **Reactive** ____________

Flammability

Flammable **Flame Sustaining** **Nonflammable**

pH **Value** ____________

Cyanide **Positive** **Negative** **Paper** **Detector**

Sulfide **Positive** **Negative** **Paper** **Detector**

Redox Potential **Reducing Agent** **Oxidizing Agent**

Reference **mV**

Sample **mV**

Comments

OVA Reading ____________ **ppm** ____________ **Analyst** ____________

HNu Reading ____________ **ppm** ____________

Radioactivity ____________ **mR/hr** ____________

Physical Description ____________

Solubility ____________ ____________

____

Figure E-5. Sample analytical report sheet.

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in units of milliroentgens per hour (mR/hr). Note that normal environmental gamma radiation background is 0.01 to 0.02 mR/hr and that the routine worker exposure rate should not be more than 2-3 times the background level.

Volatile Vapor Monitoring--

Determine the volatile vapor concentration of the waste:

- as soon as drums are staged and opened (sampler inlet positioned at drum bung hole); or
- upon receipt of samples at the laboratory (container headspace screening).

Two portable screening instruments have been identified for use in this procedure, namely the Centry Organic Vapor Analyzer and the HNu Photoionization Analyzer. Both instruments are useful as general screening tools; however, they are subject to limitations which must be recognized to properly interpret generated data.

- The instruments do not respond to all substances that may be present.
- Different instruments (specifically different detectors) do not exhibit identical responses to the same compounds.
- Extremely toxic substances such as phosgene, HCN, etc., are not detected with these instruments.
- The response is a cumulative one indicative of all detectable substances present.

pH Measurement--

- Equipment
  - Multiband pH paper with fixed indicator colors
  - 50-milliliter glass beakers
  - Disposable glass transfer pipets
- Procedure for Liquid Samples
  1. Mark sample number near top of empty beaker with permanent marker.
  2. Record sample number in notebook.
  3. Transfer approximately 5 milliliter of sample to a 50-milliliter beaker, using a transfer pipet.
  4. Dip multiband pH paper into sample, wetting all bands.

5. If necessary, carefully wipe off excess sample.

6. Compare the reaction zone band with the fixed indicator color bands to estimate the pH of the sample.

7. Record estimated pH in notebook and on Analytical Report Sheet.

8. Use this same sample aliquot for Water Reactivity/Solubility testing.

- Procedure for Solid or Tar-like Samples

1. Use the Water Reactivity sample aliquot for pH measurement, after completing the reactivity/solubility testing.

2. Dip multiband pH paper into sample, wetting all bands.

3. If necessary, carefully wipe off excess sample.

4. Compare the reaction zone band with the fixed indicator color bands to estimate the pH. This is considered an indirect pH since water has been added to the sample.

5. Record the estimated pH, marking (ind.) for indirect measurement after the value in the notebook and on the Analytical Report Sheet.

Water Reactivity/Solubility--

- Equipment

  - 50-milliliter glass beakers
  - 500-milliliter polyethylene wash bottles
  - Disposable glass Pasteur transfer pipets
  - Disposable tongue depressors
  - Deionized water at approximate temperature of samples
  - Foam plastic shaped to fit beakers. A thermocouple inserted in the bottom of the plastic holder is connected to a Digimite digital readout thermometer. Six beaker units can be accommodated.

- Reactivity Procedure

1. Mark sample number near top of empty beaker with permanent marker.

2. Record sample number in notebook.

3. Transfer approximately 5 milliliters or 5 grams of sample to beaker, using disposable pipet or tongue depressor.

4. Insert beaker into holder and let equilibrate until temperature readout is stable.

5. From a wash bottle, carefully pour approximately 5 milliliters of deionized water down the side of the sample-containing beaker so it contacts the sample slowly. Have the hood door closed as much as possible for safety.

6. Observe and record any visible reaction such as:

   - fuming or bubbling
   - color change
   - evolution of gas
   - temperature change

7. If any of Step 6 indications have occurred, classify sample as "Water Reactive" and record temperature change in notebook and on Analytical Report Sheet.

- Solubility Procedure

1. Remove beaker from foam plastic holder and swirl to mix contents.

2. Observe beaker contents and classify in notebook and on Analytical Report Sheet as follows:

   - Soluble--All of sample is in solution; only one phase exists.
   - Semisoluble--Part of the sample has dissolved in the added water and/or colored the water phase. Two or more solution phases or some undissolved solid can be seen.
   - Insoluble--None of the sample has dissolved in the added water.

It should be noted that these classifications are based on the analyst's judgment; they are not quantitative determinations of solubility.

Oxidation-Reduction (Redox) Potential--

- Equipment

- Disposable Specimen Containers with screw-on caps
- Disposable glass Pasteur transfer pipets
- Disposable tongue depressors
- pH/Millivolt Meter (Orion Model 701A or equivalent)
- Platinum Redox electrode (Orion Models 96-78 or 97-78 or equivalent)
- Electrode filling solutions:
  a. Orion 90-00-01 (proprietary mixture of salts saturated with silver)
  b. Orion 90-00-11 (4M potassium chloride saturated with silver chloride)

- Reagents
  - Test Solution A--prepare by dissolving 0.392 grams of ferrous ammonium sulfate in about 500 milliliters deionized water; add 2.8 milliliters 36N sulfuric acid and dilute to 1000 milliliters with deionized water.
  - Test Solution B--prepare by dissolving 0.194 grams of potassium chromate, previously dried at 120°C for 2 hours, in 500 milliliters deionized water; add 2.8 milliliters 36N sulfuric acid and dilute to 1000 milliliters with deionized water.

The EMF values for the test solutions should be similar to those shown below for silver/silver chloride reference electrodes. These values should be checked periodically during sample analysis.

Test Solution	Standard EMF
A (Oxidation Potential)	380 millivolts
B (Reduction Potential)	630 millivolts

- Procedure for Oxidation Potential

1. Fill the electrode with 90-00-01 filling solution for low ionic strength samples or 90-00-11 for high ionic strength samples. Since most hazardous waste samples will have high ionic strength; filling solution 90-00-11 should be used.
2. Place the electrode in a beaker containing Test Solution A and turn the function switch to the millivolt mode.

3. Record the millivolt reading in the Redox Reference Notebook and on the Analytical Report Sheet. If the potential reading is 450 or higher, clean the electrode as directed in Preventive Maintenance, or replace it with another electrode which gives a potential reading of 350-450 millivolts for Solution A.

4. Use the same reference reading for a batch of eight samples. Then repeat Steps 1 and 2 above to obtain a reference reading for the next batch of eight samples.

5. Mark the sample number near top of empty Specimen Container with permanent marker.

6. Record sample number in notebook.

7. Transfer approximately 50 milliliters or 50 grams of sample into the container.

8. Add 40 milliliters of Test Solution A.

9. Seal the container and shake vigorously for 15 seconds.

10. Let stand for 5 minutes.

11. Use a Pasteur transfer pipet to transfer the aqueous phase to a disposable beaker. If the aqueous phase cannot be readily identified, add a few drops of water to the beaker and note which phase it joins.

12. Place the electrode in the aqueous solution and turn the function switch on the meter to the millivolt mode.

13. Record the millivolt reading in notebook and on the Analytical Report Sheet.

14. Clean the electrode with a Kim-Wipe.

- Procedure for Reduction Potential

1. Follow the same procedure outlined above for Oxidation Potential, EXCEPT use Test Solution B in Steps 2 and 3. Clean or replace the electrode if the potential reading is above 700 millivolts and consider 600-700 as an acceptable range of millivolt readings.

Flammability--

- Equipment

  - 32-milliliters Wheaton vials
  - Aluminum heat block with holes drilled to accept Wheaton vials

and a dial thermometer

  - Hot plate capable of maintaining temperature of heat block at 60°C
  - Disposable glass transfer pipets
  - Small propane torch
  - Dial thermometer with appropriate range

- Procedure

  1. Mark sample number near top of empty vial with permanent marker.
  2. Record sample number in notebook.
  3. Transfer approximately 5 milliliters of sample into vial using transfer pipet.
  4. Insert vial into heat block so that sample number shows.
  5. Let equilibrate for 3 to 5 minutes.
  6. Pass propane torch across top of vial three or four times.
  7. Record in notebook if sample ignites (flames) or pops.
  8. As a final check on flammability, turn off the hood and pass the propane torch across the top of the vials once more. Note results and turn the hood on again.
  9. Designate samples as follows:
     - Flammable--Sample pops and/or flames briefly.
     - Flame sustaining--Sample sustains flame.
     - Nonflammable--Sample does not pop or flame.

Cyanide--

Note: Only samples with a pH of 4 or higher will be tested for cyanide.

- Equipment

  - 32-milliliters Wheaton vials with plastic caps
  - Disposable glass transfer pipets
  - Disposable tongue depressors

- Cyantesmo test paper (Macherey-Nagel)
- Dropping bottle of concentrated sulfuric acid (H_2SO_4)
- Drager hydrogen cyanide low range detector tubes and sampling pump

- Procedure--Cyanide Test Paper

1. Mark sample number on empty vial with permanent marker.
2. Record sample number in notebook.
3. Transfer approximately 5 milliliters or 5 grams of sample into vial using pipet or tongue depressor.
4. Add 2 drops of concentrated H_2SO_4. This step should be conducted under a hood or with other precautions against the release of cyanide gas.
5. Fold test paper strip over edge of vial so it is held in place by vial cap and extends into sample. Do this quickly so that any gas evolving is tested.
6. Cap vial and swirl to mix.
7. Look for blue stain immediately or after 15 minutes.
8. Record in notebook and on Analytical Report Sheet that this is the paper test and report results as follows:
    - Negative cyanide--if no stain appears.
    - Positive cyanide--if blue stain appears.
    - Uncertain cyanide--if stain of other color appears; describe stain.
9. Test positive and uncertain cyanide samples with detector tubes.

- Procedure--Hydrogen Cyanide (HCN) Detector Tubes

1. Place new detector tube in sampling pump following manufacturer's instructions.
2. Mark sample number on empty vial with permanent marker.
3. Record sample number in notebook.
4. Transfer approximately 5 milliliters of sample into vial using pipet.

5. Add H_2SO_4 dropwise, with swirling between each addition, to bring pH to 5 or lower. Proper precautions should be made for the potential release of cyanide gas.

6. Place detector tube over acidified vial and take appropriate number of strokes on the pump.

7. Look at detector tube scale to see if HCN has been detected.

8. Record in notebook and on Analytical Report Sheet that this is the detector test and record results as follows:

   - Negative cyanide--if no reading on scale.

   - Positive cyanide--if scale shows reading; include numerical reading.

   Note: Ammonia, chlorine, hydrogen sulfide, and sulfur dioxide may interfere with detector tube reading if present at adequate concentration.

Sulfide--

Note: Only samples with a pH of 7 or higher will be tested for sulfide.

- Equipment

  - 32-milliliters Wheaton vials with plastic caps

  - Lead acetate test paper

  - Disposable Pasteur glass transfer pipets

  - Disposable tongue depressors

  - Dropping bottle of concentrated hydrochloric acid (HCl)

- Procedure--Sulfide Test Paper

1. Mark sample number near top of empty vial with permanent marker.

2. Record sample number in notebook.

3. Transfer approximately 5 milliliters or 5 grams of sample into vial using disposable pipet or tongue depressor.

4. Quickly fold acetate paper strip over edge of vial and cap the vial. Swirl liquid samples to wet paper.

5. Look for brown to black coloration on the test paper immediately and again after 15 minutes.

6. If no stain appears, add a few drops of HCl to the vial and cap quickly. Swirl the contents and look for coloration immediately and after 15 minutes.

7. Record in notebook and on Analytical Report Sheet:

   - Negative H_2S--if no stain appears.
   - Positive H_2S--if brown or black stain appears.
   - Uncertain H_2S--if stain of other color appears; describe stain.

Calibration Procedures and Frequency--

Orion Model 701A pH/Millivolt Meter/Orion Redox Electrode 96-78--This meter/electrode system is used to determine oxidation potential and is checked three times daily, at the beginning, middle and the end of the working day. The procedure used is as follows:

- Reagents

  - Electrode Filling Solution Orion 90-00-01 (proprietary mixture of salts saturated with silver).
  - Check Solution A. Dissolve 4.22 grams potassium ferrocyanide ($K_4Fe(CN)_6 \cdot H_2O$) and 1.65 grams potassium ferricyannide ($K_3Fe(CN)_6$) in 100 milliliters deionized water.
  - Check Solution B. Dissolve 0.42 grams potassium ferrocyanide ($K_4Fe(CN)_6 \cdot 3H_2O$), 1.65 grams potassium ferricyanide ($K_3Fe(CN_6)$ and 3.39 grams potassium fluoride ($KF.2H_2O$) in 100 milliliters deionized water.

- Procedure

  1. Ensure that the redox electrode is filled with the proper filling solution.
  2. Connect the electrode to the meter and set the meter function switch to the millivolt mode.
  3. Pour Check Solution A into a clean disposable beaker.
  4. Place the electrode in the beaker and wait a short time for a stable millivolt reading. The potential should be about 192 millivolts.
  5. Clean the electrode with a Kim-Wipe.

6. Pour Check Solution B into a clean disposable beaker and take a millivolt reading as soon as stable. The potential should be about 250 millivolts.

7. If the Check Solution readings are not within ±10 percent of the expected readings, clean the electrode using procedures in Section 11 of this Plan.

Preventive Maintenance--

Orion Model 701A pH/mV Meter--Checkout and maintenance procedures given in the manufacturer's manual will be performed on a monthly basis and more frequently if the analysts using the instrument identify any problem.

Orion Redox Electrode Model 96-78 or 97-78--Hazardous waste sample tend to foul the electrode and cause the potential readings for test solutions to become higher than acceptable. The routine electrode maintenance used includes:

1. Cleaning the electrode with a Kim-Wipe after every sample.
2. Reading the potential of two check solutions three times daily.
3. Changing the filling solution every day.
4. Cleaning the electrode with dionized water following the instructions in the electrode manual when the Check Solutions show a problem.
5. Using a polishing strip on the sensing element when all other cleaning methods fail.

References--

1. GCA/Technology Division. Quality Assurance Project Plan: Onsite Characterization of Hazardous Waste Samples at Kingston, New Hampshire. Prepared for Peabody Clean Industry, Inc. October 1981.

2. Princeton Testing Laboratory. Oxidation-Reduction Measurements Procedure Field Test Kit. Princeton, New Jersey (undated).

3. Turpin, R. D., J. P. LaFornara, H. L. Allen and U. Frank. Compatibility Field Testing Procedures for Unidentified Hazardous Wastes. In: National Conference on Management of Uncontrolled Hazardous Waste Sites. Washington, DC. October 1981.

APPENDIX F

PACKAGING, MARKING, LABELING, AND SHIPPING OF HAZARDOUS WASTE SITE SAMPLES

General Provisions

The basic sample types collected during hazardous waste site investigations can be classified as follows: (1) environmental samples, (2) hazardous waste site samples, and (3) hazardous waste/oil mixture samples.

Environmental samples are specifically exempt by Department of Transportation (DOT) regulations from hazardous categorization and may be shipped according to procedures detailed later in this section. Other specific exemptions may apply in other cases as with the use of special packaging for samples [e.g., Labelmaster, Inc.,* Package No. 38; Dow Chemical Company* Imbiber Pack for shipment of Poison B, n.o.s. by United Parcel Service;* Air Shipment of 5 percent nitric acid in 25 ml ampoules (DOTE 8116); certain preservatives (April 11, 1979 and December 18, 1980 letters from Alan I. Roberts); and samples of discharge subject to National Pollutant Discharge Elimination System (NPDES) regulations (40 CFR 260.4a)].

If the shipper believes that any sample contains a Department of Transportation regulated material, the sample must be packed and labeled according to the requirements set forth in the DOT hazardous materials table shown in 49 CFR 172.101. When dealing with unanalyzed hazardous waste site samples, however, the shipper will usually not know if a sample contains a DOT regulated material. If these samples cannot be classified as environmental samples or exempted as previously specified, then they must be packaged, labeled and shipped to ensure compliance with hazardous material transportation regulations.

The EPA recommended procedures** detailed later in this section meet the DOT standard requirement for all packages as specified in 40 CFR 173.24. In general, these standard requirements are as follows:

---

*Mention of the name of a particular corporation or product is not an endorsement of that corporation or product.

**From National Guidance for Compliance with Department of Transportation Regulations in the Shipment of Environmental Laboratory Samples, March 6, 1981 signed jointly by Deputy Assistant Administrators for Water Enforcement, Drinking Water, Monitoring and Technical Support, and Water Regulations and Standards.

General Packaging Requirements--

Each package used for shipping hazardous materials....shall be so designed and constructed, and its contents so limited, that under conditions normally incident to transportation:

1. There will be no significant release of the hazardous material to the environment;

2. The effectiveness of the packaging will not be substantially reduced; and

3. There will be no mixture of gases or vapors in the package which could, through any credible spontaneous increase of heat or pressure, or through an explosion, significantly reduce the effectiveness of the packaging.

General Packaging Requirements; Air Shipments--

In addition, shipments by air must also meet the requirements of 49 CFR Section 173.6:

1. ....each package must be designed and constructed to prevent leakage that may be caused by changes in altitude and temperature during air transportation.

2. Inner containers that are breakable (such as earthenware, glass, or brittle plastic), must be packaged to prevent breakage and leakage under conditions normally incident to transportation. These completed packages must be capable of withstanding a 4 foot drop on to solid concrete in the position most likely to cause damage. Cushioning and absorbent materials must not be capable of reacting dangerously with the contents....

3. For any packaging with a capacity of 110 gallons or less containing liquids, sufficient ullage* must be provided to prevent liquid contents from completely filling the packaging at 130°F (55°C). The primary packaging (which may include composite packaging), for which retention of the liquid is the basic function, must be capable of withstanding, without leakage, an internal absolute pressure of no less than 26 lb/sq in. or no less than the sum of the absolute vapor pressure of the contents at 130°F (55°C) and the atmospheric pressure at sea level, whichever is greater.

4. Stoppers, corks, or other such friction-type closures must be held securely, tightly and effectively in place with wire, nylon reinforced tape, or other positive means. Each screw-type closure on any inside plastic packaging must be secured to prevent the closure from loosening due to vibration or substantial changes in temperature or pressure.

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*Ullage is the gas/air space at the top of the bottle.

General Transportation Requirements--

Transportation of samples is also regulated by DOT. Environmental samples may be shipped by any means available with consideration being given to the holding time requirements of 40 CFR 165. Unanalyzed samples from hazardous waste sites may be transported by any rented car or truck, common carrier truck, bus, railroad, or by cargo only air carriers but they may not be transported by common carrier passenger air carrier. Prior arrangements with air cargo companies may facilitate shipment. DOT regulations do not apply to transportation by any government owned or operated vehicle, including aircraft; however, EPA personnel will use the packaging procedures described below except when a Bill of Lading with certification form is not required (see "Shipping Papers").

Packaging, Marking, Labeling Requirements for Environmental Samples

Samples judged to be environmental samples should be packaged and shipped by the following EPA recommended procedure:

1. Sample volume should be limited to the quantity necessary to conduct the requisite analysis and the smallest appropriate container should be used.

2. Plastic containers should be used unless EPA approved analytical methods require glass.

3. Plastic or glass containers should have screw-type lids. If it is necessary to use stoppers, corks or other friction-type closures, they must be held securely in place with wire or nylon reinforced tape.

4. Samples which by EPA approved analytical methods are required to be preserved with ice should be placed in sturdy plastic bags or containers which can be sealed to minimize ice water leakage. When dry ice is used to preserve plant or animal tissue and the package is to be offered for transportation by air, the packaging must be designed and constructed to permit the release of carbon dioxide gas. The air carrier should be notified well in advance of shipment. The package should be marked "carbon dioxide, solid" or "dry ice" and "frozen diagnostic specimens."

5. Shipping containers--All sample containers are to be placed inside a strong outside shipping container. A metal picnic cooler (ice chest) lined inside with hard plastic complies with the DOT drop test requirement.* Care must be taken to secure the drainage hole at the bottom of the cooler so that if a sample container or an ice bag leaks, the contents cannot escape the shipping container through the drain hole. The container should also be taped shut to achieve as tight a seal as possible around the lid to prevent leakage should the container be accidently turned over.

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*Tests conducted by the NEIC show that these coolers pass the 4-foot drop test.

6. Glass containers--The container's screw-type lid must be tightened before it is placed in the shipping container. In the shipping container glass bottles should be separated by cushioning or absorbent material (e.g., styrofoam, blotting paper or newspaper) to prevent contact with other hard objects and prevent breakage. For example, a 1-gallon glass bottle (organic sample) can be placed between two carved out styrofoam sheets which secure the bottle at the top and bottom. Small glass bottles (volatile organic samples) can be placed inside a 1-quart plastic cubic container with screwtype lids to minimize breakage and contain leakage.

7. Plastic containers--Polyethylene bottles or cubic containers do not require cushioning materials to prevent breakage but do need to be protected from puncture by sharp objects. Caps are to be tightly screwed on before the plastic containers are placed in the shipping container.

8. Ice can be placed in separate sealed plastic bags, or in large-mouthed plastic cubic containers with screwtype lids. As an alternative, sample bottles and ice can be placed together in a large sturdy plastic bag which will provide an additional waterproof lining in the shipping container. After all sample containers have been carefully arranged and ice has been added, the plastic bag should be tightly closed with wire, nylon reinforced tape or other positive means.

9. Place a copy of the chain-of-custody form in the shipping container before closing and sealing it.

10. Close and seal the shipping container in the manner described above under "Shipping Containers."

The shipping container must be marked "This END UP" and arrows indicating the proper upward position of the container should be affixed. A sticker showing the Agency program office's name and address must be placed on the outside of the cooler.

Packaging, Marking and Labeling Requirements for Unanalyzed Samplings from Hazardous Waste Sites

When a reasonable doubt exists as to sample class, function and labeling requirements for sample transportation, DOT (49 CFR 173.2) indicates that the material should be classified according to the following order of hazards:

1. Radioactive material
2. Poison A
3. Flammable gas
4. Nonflammable gas
5. Flammable liquid

6. Oxidizer
7. Flammable solid
8. Corrosive material (Liquid)
9. Poison B
10. Corrosive material (solid)
11. Irritating materials
12. Combustible liquid (in containers having capacities exceeding 110 gallons)

Samples taken onsite during an investigation of a hazardous waste facility, blended waste oil facility, etc. are considered to be contaminated and hazardous; they are to be handled as flammable liquid (or flammable solid) for shipping and packaged accordingly. This is because the prioritized DOT classification above established only radioactive material, Poison A, and gases as more hazardous than flammable liquid. The possibility of radioactive materials in samples is eliminated by the use of a radiation survey meter for personnel safety when entering the site; it is extremely unlikely that Poisons A are present on hazardous waste sites because most of them are gases or very volatile liquids; gases are normally not sampled or shipped. Moreover, field flashpoint testing to reduce the packaging requirements is both impractical and extremely dangerous. Poison A packaging and shipping procedures are described later in this section if they should be needed.

Packaging, Marking and Labeling Requirements for Flammable Liquid (or Flammable Solid) n.o.s.

1. Collect sample in an 8-ounce or smaller glass container with a nonmetallic, Teflon-lined screw cap. Allow sufficient ullage (approximately 10 percent by volume) so container is not full of liquid at 130°F (55°C). This does not apply for samples collected expressly for volatile organic analysis. If collecting a solid material, the net weight must not exceed 1 pound.

2. Attach properly completed Sample Identification Tag to the sample container.

3. Tightly close sample container and place it in a 2-mil-thick (or thicker) polyethylene bag, one sample per bag. Sample tag should be positioned for reading through the bag. Close the bag with a wire, reinforced tape or other secure means.

4. Mark a metal can with the sample number and list the appropriate data on a chain-of-custody form.

5. Place the sealed bag inside the marked metal can with incombustible, absorbent cushioning material (e.g., vermiculite or diatomaceous [fuller's] earth) to prevent breakage, one sample per can. Pressure close the can and use clips, tape or other positive means to hold the lid securely, tightly and effectively closed.

6. Place one or more metal cans, surrounded with incombustible packing material for stability during transport, into a strong outside container such as a metal picnic cooler or a strong fiberboard box.

7. Place chain-of-custody form inside the shipping container before closing and sealing.

8. Close and lock or seal shipping container.

9. Marking and Labeling--Use abbreviations only where specified. Using the stickers prepared for this purpose or by hand printing, place the following information on the shipping container: laboratory name and address, "Flammable Liquid, n.o.s.,* UN 1993", (if solid, use "Flammable Solid, n.o.s., UN 1325"), "Limited Quantities" or "LTD. QTY.", "This end up" or "This side up" and arrows. Also on the outside of the container place the following labels: "Cargo Aircraft Only,"** "Flammable Liquid" or "Flammable Solid" ("Dangerous When Wet" label should be used if the solid has not been exposed to a wet environment).

10. Shipping Papers--Use abbreviations only where specified below. Complete the Bill of Lading and sign the certification statement (if the carrier does not provide one use the standard industry form) with the following information in the order listed. A form may be used for more than one shipping container (see attached examples). "Flammable Liquid, n.o.s., UN 1993" (or Flammable Solid, n.o.s., Flammable Solid, UN 1325" as appropriate, "Cargo Aircraft Only",** "Limited Quantities" or LTD. QTY.," "Net Weight " or "Net Volume ___," by item, if there is more than one sample can in the shipping container (e.g., "24 at 6 oz." rather than "144 oz.").

11. A team member must accompany shipping container(s) to the carrier and, if required, open outside container(s) for carrier inspection.

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*Using "Flammable" does not convey the certain knowledge that a sample is or group of samples are in fact flammable, or indicate how flammable they are; it is, rather, intended to prescribe the class of packaging in order to comply with DOT regulations; "n.o.s." means not otherwise specified.

**Use this label only if the total quantity in the package exceeds 1 quart liquid. Maximum net quantity in each package cannot exceed 10 gallons for flammable liquids and 25 pounds for flammable solids.

Packaging, Marking, Labeling, and Shipping Requirements for Flammable Liquid, Corrosive, n.o.s.

If a sample exhibits corrosive properties, it must be packaged and shipped as Flammable Liquid, Corrosive, n.o.s. RCRA defines an aqueous solution as corrosive if the pH is ≤ 2 or ≥ 12.5. DOT does not specify pH limits but uses criteria based on a materials ability to produce skin rash or corrosion on steel. Shipping requirements for materials that are corrosive are as follows:

1. Collect the sample in a 1-quart glass container and close it with a nonmetallic, Teflon-lined screw cap. Allow adequate ullage (about 10 percent by volume) so the container will not be liquid full at 130°F (55°C).

2. Attach a properly filled out sample identification tag to the sample container.

3. Place the quart container inside a 12B fiberboard box with incombustible, absorbent cushioning material (vermiculite or diatomaceous earth). Polyethylene bags are not used for quart corrosive sample bottles. Use tape to close the box, apply both "Flammable Liquid" and "Corrosive" labels and mark box "Flammable Liquid, Corrosive, n.o.s., UN 2924," the laboratory name and address, "This side up" or "This end up" and arrows.

4. Place the fiberboard box(es), surrounded with sufficient additional, incombustible, absorbent cushioning material to absorb the contents of broken containers, into a strong shipping container as previously described.

5. Place a properly filled out chain-of-custody record form in the shipping container; close and lock or seal the container.

6. A team member must accompany shipping container(s) to the carrier and, if required, will open outer container for verification of inside packaging by the carrier's agent.

Packing, Marking, Labeling and Shipping Requirements for Samples Classified as Poison A

Samples suspected of containing one of the liquids classified by DOT as Poison A must be shipped in conformance to the following specifications (49 CFR 173.328):

1. Collect the sample in a polyethylene or glass container which has an outer diameter smaller than the valve hole of a DOT Spec. 3A1800 or 3AA1800 metal cylinder for 2-25 pressurized gas. Allow sufficient ullage (about 10 percent by volume) so it is not liquid-full at 130°F (55°C). Seal the sample container as appropriate.

2. Attach a properly filled out sample Identification Tag to the sample container.

3. Using a string or flexible wire attached to the neck of the sample container, lower it into a metal cylinder (DOT Spec. 3A1800 or 3AA1800) which has been partly filled with incombustible, absorbent loose packing material (vermiculite or diatomaceous earth). Fill the cylinder to the valve hole with more of the packing material using care to assure sufficient packing between the sample container and the sides, bottom and top of the cylinder to prevent breakage. Drop the string or wire into the valve hole. Use one cylinder for each sample of Poison A.

4. Install the cylinder valve, use 250 ft-lb of torque (for a 1-inch opening) and replace the valve protector on the cylinder using Teflon tape.

5. Marking and labeling the cylinder--Use abbreviations only where specified. Place the information below on the side of the cylinder or on a metal tag wired to the valve protector. Use hand printing or prepared labels.

   "Poisonous* liquid, n.o.s., NA 1955" or "Poisonous gas, n.o.s., NA 1955," laboratory name and address.

   Place a "Poisonous Gas" label on the cylinder. A "Poisonous Liquid" label may not be used, even if the sample is liquid.

6. Cylinders may be shipped as is or several may be packed in an overpack. A properly filled out chain-of-custody record form must be placed in the shipping container or must otherwise accompany the shipment.

7. Mark and label the shipping container as follows: Use the same labels and printing as on the cylinder (see No. 5 above) and in addition mark the container "Laboratory Sample," "Inside Packages Comply with Prescribed Specifications," and "THIS SIDE UP" or "THIS END UP" and arrows should be placed on the outside in an appropriate location.

8. Shipping papers--Complete the Bill of Lading and complete and sign the certification statement (if the carrier does not provide one, use the standard industry form). Use the following information in the order given. A form may be used for more than one shipping container; use abbreviations only as indicated.

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*"Poisonous" does not convey the certain knowledge that a sample is in fact poisonous, nor how poisonous it may be; it is, rather intended to establish the class of packaging being used to comply with DOT regulations.

"Poisonous liquid, n.o.s., Poison A, NA 1955" or "Poisonous gas, Poison A, n.o.s., NA 1955," "Limited Quantity" or "LTD QTY," "Laboratory Samples," "Net Weight ______" or "Net Volume _____" (of hazardous contents) by cylinder, if more than one cylinder is contained in a shipping container and "Poison A" for hazard class. The net weight or net volume must be placed just before or after the "Poisonous liquid, n.o.s., NA 1955" or "Poison gas, n.o.s., NA 1955" marking.

9. Materials classified and packed as Poison A may not be shipped by nongovernment aircraft. Unless samples are driven to the laboratory, a team member must accompany the shipping container(s) to the carrier and will, if required, open the shipping container for inspection of the contents.

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